

မြန်မာနိုင်ငံ ရင်းနှီးမြှုပ်နှံမှုကော်မရှင်  
ရန်ကုန်မြို့။

INFO MYANMAR UNIVERSITY (IMU)

တည်ထောင်ဆောင်ရွက်မည့်  
အတည်ပြုချက်လျှောက်ထားတင်ပြခြင်း။

Daw Nu Nu Thant (Managing Director)

IMCS Company Limited



## Info Myanmar University (IMU)

# မာတိကာ

- အတည်ပြုလျှောက်ထားလွှာ (ပုံစံ - ၄-က)
- လိုင်စင်၊ ပါမစ်၊စာချုပ်စာတမ်း မိတ္တူများ
- ပုဂ္ဂလိက ကျောင်းအမျိုးအစား၊ ကျောင်းအမျိုးအစားအလိုက် ထားရှိမည့်ပရဝဏ်၏ အကျယ်အဝန်း
- စီမံခန့်ခွဲအုပ်ချုပ်မည့် အဖွဲ့အစည်းဝင်များ၏ ပညာအရည်အချင်း အထောက်အထား နှင့် ဘာသာရပ်အလိုက် သင်ကြားမည့် ပုဂ္ဂလိက ကျောင်းဆရာ၊ဆရာမများ၏ ဘွဲ့လက်မှတ်၊ အထောက်အထားများ၊ သင်ကြားရေး အတွေ့အကြုံများ နှင့် ကိုယ်ရေးအကျဉ်း
- ပုဂ္ဂလိကကျောင်းဆရာ၊ဆရာမများ နှင့် စီမံခန့်ခွဲရေး ဝန်ထမ်းများ လုံလောက်မှုရှိကြောင်း ဝန်ခံကတိ
- ပေးအပ်မည့် သင်တန်းဆင်းလက်မှတ်၊ အောင်လက်မှတ် နှင့် ဒီပလိုမာ၊ ဘွဲ့လက်မှတ် အမျိုးအစားများနှင့် အသိအမှတ်ပြုသည့် အဖွဲ့အစည်း
- ပေးအပ်မည့် သင်တန်းဆင်းလက်မှတ်၊ အောင်လက်မှတ် နှင့် ဒီပလိုမာ၊ ဘွဲ့လက်မှတ်၏ နမူနာပုံစံများ
- ဝန်ဆောင်မှုပေးမည့် အစီအစဉ် နှင့် ဝန်ဆောင်ခ နှုန်းထားများ
- သင်ကြားမည့် အစီအစဉ်၊ သင်ရိုးညွှန်းတမ်း နှင့် လုပ်ငန်းအကျဉ်းချုပ်
- ဝန်ထမ်းသက်သာချောင်ချိရေး အစီအစဉ်
- ကျန်းမာသန့်ရှင်းရေး၊ ကျောင်းလုံခြုံရေး နှင့် မီးဘေးကာကွယ်ရေး အစီအစဉ်
- လူမှုရေးဆိုင်ရာ ဆောင်ရွက်ချက်များ
- အရက်သေစာနှင့် မူးယစ်ဆေးဝါး သုံးစွဲခြင်းမရှိစေရေး ဝန်ခံကတိပြုလွှာ
- အမျိုးသား ပညာရေးဥပဒေ၊ တည်ဆဲပညာရေးဆိုင်ရာ ဥပဒေများနှင့် နောင်ထွက်ပေါ်လာမည့် ပညာရေး ဥပဒေများကို လိုက်နာဆောင်ရွက်သွားမည်ဖြစ်ကြောင်း ဝန်ခံကတိ





**Info Myanmar University (IMU)**

အတည်ပြုလျှောက်ထားလွှာ (ပုံစံ - ၄က)



သို့.

ဥက္ကဋ္ဌ

မြန်မာနိုင်ငံ ရင်းနှီးမြှုပ်နှံမှုကော်မရှင်

ရန်ကုန်မြို့။

စာအမှတ် ။ ။ IMC/Admin/2019(174)

ရက်စွဲ ။ ။ ၂၀၁၉ ခုနှစ်၊ မေလ၊ ၉ရက်။

အကြောင်းအရာ။

။ Info Myanmar University ဖွင့်လှစ်ဆောင်ရွက်နိုင်ရန် အတည်ပြုချက်

တင်ပြလျှောက်ထားခြင်း

အထက်အကြောင်းအရာပါကိစ္စနှင့်စပ်လျဉ်း၍ ကျွန်ုပ်တို့၏ IMCS (Institute of Management & Computer Studies) Company Limited ၊ ကုမ္ပဏီ မှတ်ပုံတင်အမှတ် (103990572)သည် ဝန်ဆောင်မှုလုပ်ငန်း အမျိုးအစား ဆောင်ရွက်လုပ်ကိုင်ခွင့် ရရှိပြီး Info Myanmar College တည်ထောင်ကာ ပညာရေးဝန်ဆောင်မှု လုပ်ငန်းများကို စဉ်ဆက်မပြတ် ဆောင်ရွက်လျက်ရှိပါသည်။ ယခုအချိန်အခါတွင် Info Myanmar University အမည်ဖြင့် သင်ကြားဆောင်ရွက်နိုင်ရေးအတွက် မြန်မာနိုင်ငံ ရင်းနှီးမြှုပ်နှံမှုကော်မရှင် (Myanmar Investment Commission) သို့ အတည်ပြုချက်ကို တင်ပြ လျှောက်ထားအပ်ပါသည်။

လေးစားစွာဖြင့်

Founder & Managing Director

IMCS Co., Ltd.

အတည်ပြုလျှောက်ထားလွှာ

သို့.

ဥက္ကဋ္ဌ

မြန်မာနိုင်ငံ ရင်းနှီးမြှုပ်နှံမှုကော်မရှင်

စာအမှတ် ။ ။IMC/Admin/2019(176)

ရက်စွဲ ။ ။ ၂၀၁၉ ခုနှစ် ဇွန်လ ၆ ရက်

ကျွန်တော်/ ကျွန်မသည် မြန်မာနိုင်ငံရင်းနှီးမြှုပ်နှံမှု ဥပဒေပုဒ်မ ၃၇ နှင့်အညီ အောက်ဖော်ပြပါ အချက်များကို ဖြည့်စွက်၍ အတည်ပြုလျှောက်ထားလွှာကို တင်ပြလျှောက်ထားအပ်ပါသည်။

၁။ ရင်းနှီးမြှုပ်နှံလိုသူ၏-

(က) အမည်

ဒေါ်နနသန့်

(ခ) ကုမ္ပဏီ မှတ်ပုံတင်အမှတ် သို့မဟုတ်

IMCS (Institute of Management & Computer Studies) Co., Ltd. - 103990572

ရင်းနှီးမြှုပ်နှံသူ၏နိုင်ငံသားစိစစ်ရေး ကတ်အမှတ်/

၁၁/ ရဗန (နိုင်) ၀၄၉၂၇၇

နိုင်ငံကူးလက်မှတ် အမှတ်

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(ဂ) နိုင်ငံသား

မြန်မာ

(ဃ) နေရပ်လိပ်စာ/ မှတ်ပုံတင်ထားသည့် ကုမ္ပဏီ လိပ်စာ

အမှတ် ၅၆၊အောင်မင်းခေါင်(၁)လမ်း၊ ၁၀ရပ်ကွက်၊  
ဝင်ဒါမီယာ၊ကမာရွတ်မြို့နယ်။

(င) တယ်လီဖုန်း/ဖက်စ်/

+၉၅ ၉ ၂၅၉၅၈၀၀၀၅ ၊ +၉၅ ၁ ၅၁၄၉၄၄

အီးမေးလ်လိပ်စာ

admin@imcscompany.com

(စ) လုပ်ငန်းအမျိုးအစား (အသေးစိတ်ဖော်ပြပေးရန်)

ပညာရေးဝန်ဆောင်မှုလုပ်ငန်း

မှတ်ချက် ။ ။ အောက်ပါ အချက်များကို ပူးတွဲတင်ပြရန် -

(၁) ကုမ္ပဏီ မှတ်ပုံတင်အထောက်အထား မိတ္တူ

(၂) နိုင်ငံသားစိစစ်ရေးကတ် မိတ္တူ နှင့် နိုင်ငံကူးလက်မှတ် မိတ္တူ



၂။ ရင်းနှီးမြှုပ်နှံသူကိုယ်တိုင် လျှောက်ထားခြင်း မဟုတ်ပါက လျှောက်ထားသူ၏ -

(က) အမည်	ဒေါ်နွယ်နွယ်ဦး
(ခ) ဆက်သွယ်ရမည့် ပုဂ္ဂိုလ်အမည်	ဒေါ်နနသန့်
(လျှောက်ထားသူသည် စီးပွားရေး အဖွဲ့အစည်းဖြစ်ပါက)	
(ဂ) နိုင်ငံသားစိစစ်ရေး ကတ်အမှတ် / နိုင်ငံကူးလက်မှတ် အမှတ်	၁၂/ သလန(နိုင်) ၀၀၇၅၃၆
(ဃ) နိုင်ငံသား	မြန်မာ
(င) မြန်မာနိုင်ငံတွင်နေထိုင်သည့် နေရပ်လိပ်စာ	အမှတ် ၄-က၊ တေလမ်း၊ ပဲခူးစုရပ်ကွက်၊ သန်လျင်မြို့နယ်၊ ရန်ကုန်၊
(စ) တယ်လီဖုန်း/ဖက်စ်	+၉၅ ၉ ၄၄၈၀၀၂၂၈၈ ၊ +၉၅ ၁ ၅၁၄၉၄၄
(ဆ) အီးမေးလ်လိပ်စာ	nwenweoo@imcscorporation.com

မှတ်ချက် ။ ။တရားဝင် ကိုယ်စားလှယ်လွှဲစာ ပူးတွဲတင်ပြရန်

၃။ ဖွဲ့စည်းမည့် စီးပွားရေး အဖွဲ့အစည်းပုံသဏ္ဌာန်

- ☒ ရာခိုင်နှုန်းပြည့်    ☐ ဖက်စပ်ပြုလုပ်ခြင်း (ဖက်စပ်စာချုပ် မူကြမ်းတင်ပြရန်)
- ☐ အခြားသဘောတူညီချက်ပုံစံတစ်မျိုးမျိုးဖြင့် ဆောင်ရွက်ခြင်း (စာချုပ် မူကြမ်းတင်ပြရန်)

မြန်မာနိုင်ငံသား ရင်းနှီးမြှုပ်နှံသူ၏ အစုရှယ်ယာပိုင်ဆိုင်မှုအချိုး ..... %

အစိုးရဌာန၊ အစိုးရ အဖွဲ့အစည်း ၏ အစုရှယ်ယာပိုင်ဆိုင်မှုအချိုး ..... %

နိုင်ငံခြားသား ရင်းနှီးမြှုပ်နှံသူ၏ အစုရှယ်ယာပိုင်ဆိုင်မှုအချိုး ..... %

၄။ အစုရှယ်ယာ ၁၀% နှုန်း နှင့် အထက်ပိုင်ဆိုင်သော အစုရှယ်ယာရှင်များ စာရင်း

စဉ်	အစုရှယ်ယာရှင်အမည်	နိုင်ငံသား	အစုရှယ်ယာပိုင်ဆိုင်မှု %
၁	ဒေါ်နနသန့်	မြန်မာ	၉၀%
၂	ဦးကောင်းမြတ်ပိုင်	မြန်မာ	၁၀%



၅။ ကုမ္ပဏီဖွဲ့စည်းခြင်းနှင့် သက်ဆိုင်သော အချက်အလက်များ

(က) ခွင့်ပြု မတည်ငွေရင်း ကျပ် ၁၀၀,၀၀၀,၀၀၀

(ခ) အစုရှယ်ယာ အမျိုးအစား Nominal

(ဂ) အစုရှယ်ယာဝင်များက ထည့်ဝင်မည့် အစုရှယ်ယာပမာဏ - ကျပ် ၅၀,၀၀၀,၀၀၀

မှတ်ချက်။ ။ သင်းဖွဲ့မှတ်တမ်း / သင်းဖွဲ့စည်းမျဉ်း သို့မဟုတ် ကုမ္ပဏီ ဖွဲ့စည်းပုံ အခြေခံစည်းမျဉ်း ပူးတွဲတင်ပြရန်။

၆။ မတည်ငွေရင်း နှင့် သက်ဆိုင်သည့်အချက်အလက်များ

(က) ပြည်တွင်းမှထည့်ဝင်သည့် မတည်ငွေရင်း

ပမာဏ / ရာခိုင်နှုန်း

(ခ) နိုင်ငံခြားမှ ယူဆောင်လာသည့် မတည်ငွေရင်း

ပမာဏ / ရာခိုင်နှုန်း

စုစုပေါင်း

ကျပ် / US\$(သန်းပေါင်း)

၁၅၀၀

-

၁၅၀၀

၇။ ရင်းနှီးမြှုပ်နှံမှု ပြုလုပ်လိုသည့် သက်တမ်း

၈။ ဆောင်ရွက်မည့် စီးပွားရေးအဖွဲ့အစည်းနှင့် သက်ဆိုင်သောအချက်အလက်များ -

(က) ရင်းနှီးမြှုပ်နှံမှုပြုလုပ်မည့်ဒေသ(များ) / တည်နေရာ

(၁) ၅၀၇/၇၊ ပြည်ရိပ်သာလမ်း၊ ဓရပ်ကွက်၊  
ပြည်လမ်း၊ကမာရွတ်မြို့နယ်၊  
ရန်ကုန်တိုင်းဒေသကြီး။

(၂) မြေကွက်အမှတ် ၁၀၂ စီ/၃၉ နှင့်

၁၀၂စီ/၄၀ မြေတိုင်းအမှတ်

၃၆အီး၊အောင်မင်းခေါင်လမ်း၊ ၁၀ရပ်ကွက်၊

ဝင်ဒါမီယာ၊ကမာရွတ်မြို့နယ်။

(ခ) ရင်းနှီးမြှုပ်နှံမှု တန်ဖိုး/ ပမာဏ

ကျပ်သန်းပေါင်း ၁၅၀၀

၉။ သက်ဆိုင်ရာ အဖွဲ့အစည်းများ ၏ ခွင့်ပြုချက်၊ လိုင်စင်၊ ပါမစ် စသည်တို့ ရရှိပြီးပါက ပူးတွဲ တင်ပြရန်

၁၀။ လုပ်ငန်းစတင်ဆောင်ရွက်နေခြင်း ☒ ရှိ၊ ☐ မရှိ

ရှိပါက လုပ်ငန်းဆောင်ရွက်မှုအခြေအနေကို ဖော်ပြပေးရန်

IMCS သည် ၂၀၀၇ ခုနှစ်တွင် IMCS Computer Center အနေဖြင့် နိုင်ငံတကာအသိအမှတ်ပြု ကွန်ပျူတာ ကျွမ်းကျင်မှု International Skills Certification သင်တန်းများကို စတင်ဖွင့်လှစ် သင်ကြားခဲ့ပြီး ၂၀၁၃ ခုနှစ် နိုဝင်ဘာလ ၇ရက်တွင် IMCS (Institute of Management & Computer Studies) အဖြစ် ကုမ္ပဏီ မှတ်ပုံတင်ခဲ့သည်။ ထို့နောက် Info Myanmar College ကိုတည်ထောင်ကာ Pearson Education, UK နှင့် ချိတ်ဆက်၍ Higher National Diploma (Computing, Network Engineering, Software Engineering) သင်တန်းများကို စတင်သင်ကြားခဲ့သည်။ ၂၀၁၇ ခုနှစ် တွင် အင်္ဂလန်နိုင်ငံ အစိုးရ အသိအမှတ်ပြု တက္ကသိုလ်ကြီးဖြစ်သော Edinburgh Napier University နှင့် Partner အဖြစ် ချိတ်ဆက်၍ B.Sc (Hons) Computing ကို T&E (Transnational Education) Program အနေဖြင့် သင်ကြားလျက် ရှိသည်။

၁၁။ အတည်ပြုလျှောက်ထားလွှာ နှင့်အတူ အောက်ဖော်ပြပါ လျှောက်ထားလွှာများကို တင်ပြလျှောက်ထားခြင်းရှိ/မရှိ ဖော်ပြရန်

☐ မြေအသုံးပြုခွင့်လျှောက်ထားလွှာ

☐ အခွန်ကင်းလွတ်ခွင့် သို့မဟုတ် သက်သာခွင့်လျှောက်ထားလွှာ

လျှောက်ထားသူလက်မှတ်

အမည် - ဒေါ်နနသန့်

ရာထူး - Founder & Managing Director

ဌာန/ကုမ္ပဏီတံဆိပ်- IMCS

(Institute of Management & Computer Studies) Co, Ltd.

ရက်စွဲ - ၇.၆.၂၀၁၉



MANAGING DIRECTOR & FOUNDER  
IMCS LTD

### ကတိဝန်ခံချက်

အထက်ဖော်ပြပါ လျှောက်ထားသူမှပေးအပ်သည့် အချက်အလက်များအားလုံးသည် မှန်ကန်မှု ရှိကြောင်း အာမခံပါသည်။

ဤအတည်ပြုလျှောက်ထားလွှာတွင် အတည်ပြုမိန့်ထုတ်ပေးရန်အတွက်ကော်မရှင်မှ စိစစ်ရာ၌ လိုအပ်သည့် အချက်အလက်များကို လျှောက်ထားသူကပေးအပ်ရန် ပျက်ကွက်ပါက အတည်ပြုလျှောက်ထားလွှာကို ငြင်းပယ်ခြင်း သို့မဟုတ် စိစစ်ရာ၌ မလိုလားအပ်သည့် နှောင့်နှေးကြန့်ကြာခြင်းတို့ ဖြစ်ပေါ်နိုင်ကြောင်း ကောင်းစွာသဘောပေါက်နားလည် ပါသည်။

မြန်မာနိုင်ငံရင်းနှီးမြှုပ်နှံမှုကော်မရှင်မှချမှတ်မည့်စည်းမျဉ်းစည်းကမ်းများကိုလည်းလိုက်နာမည် ဖြစ်ကြောင်း ဝန်ခံကတိပြုအပ်ပါသည်။

လျှောက်ထားသူလက်မှတ်

အမည် - ဒေါ်နနသန့်



ရာထူး - Founder & Managing Director

ဌာန/ကုမ္ပဏီတံဆိပ်- IMCS (Institute of Management & Computer Studies) Co, Ltd.







သို့.

ဥက္ကဋ္ဌ

မြန်မာနိုင်ငံ ရင်းနှီးမြှုပ်နှံမှုကော်မရှင်

ရန်ကုန်မြို့။

စာအမှတ် ။ ။ IMC/Admin/2019(175)

ရက်စွဲ ။ ။ ၂၀၁၉ ခုနှစ်၊ မေလ၊ ၉ရက်။

အကြောင်းအရာ။

။ ကိုယ်စားလှယ်လွှဲအပ်ခြင်း

အထက်အကြောင်းအရာပါကိစ္စနှင့်စပ်လျဉ်း၍ ကျွန်ုပ်တို့၏ IMCS (Institute of Management & Computer Studies) Company Limited ၊ ကုမ္ပဏီ မှတ်ပုံတင်အမှတ် (103990572)သည် ဝန်ဆောင်မှုလုပ်ငန်း အမျိုးအစားဆောင်ရွက်လုပ်ကိုင်ခွင့် ရရှိပြီး Info Myanmar College တည်ထောင်ကာ ပညာရေးဝန်ဆောင်မှု လုပ်ငန်းများကို စဉ်ဆက်မပြတ် ဆောင်ရွက်လျက်ရှိပါသည်။ ယခုအချိန်အခါတွင် Info Myanmar University အမည်ဖြင့် ဆောင်ရွက်လုပ်ကိုင်ခွင့်ကို မြန်မာနိုင်ငံ ရင်းနှီးမြှုပ်နှံမှုကော်မရှင် မှတစ်ဆင့် အတည်ပြုချက် တင်ပြ လျှောက်ထားနိုင်ပါရန်အတွက် အောက်ဖော်ပြပါ ပုဂ္ဂိုလ်အား လုပ်ငန်းကိုယ်စားလှယ်အဖြစ်ခန့်အပ်ပါကြောင်း နှင့် ဆောင်ရွက်ခွင့်ပြုပါရန် လေးစားစွာတင်ပြအပ်ပါသည်။

လုပ်ငန်းကိုယ်စားလှယ်

၁။ အမည်

၂။ အဖအမည်


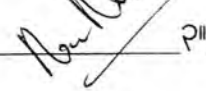
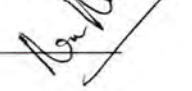
၃။ မှတ်ပုံတင်အမှတ်

၄။ ထိုးမြဲလက်မှတ် နမူနာ

ဒေါ်နွယ်နွယ်ဦး

ဦးထိန်ဝင်း

၁၂/ သလန(နိုင်)၀၃၅၅၇၃၆

၁။  ၂။  ၃။ 

လေးစားစွာဖြင့်



နနသန့်

Founder & Managing Director

IMCS Co., Ltd.



**နိုင်ငံသား စိစစ်ရေး ကတ်ပြား**

အရပ်... ၅' ၃"

သွေးအုပ်စု...

ထင်ရှားသည့်

အမှတ် အသား... လည်ဖိ

ဖွဲ့စည်းမှု အစီအစဉ်

အမည်... မန္တလေး

ဖခင်၏အမည်... မန္တလေး

မွေးသက္ကရာဇ်... ၁၉၅၇

လူမျိုး... မြန်မာ

ကိုးကွယ်သည့်ဘာသာ... ဗုဒ္ဓ



အမှတ်... ၀၄၉၂၇၇

ရက်စွဲ...

ထုတ်ပေးသည့်လက်မှတ်

အမည်... မန္တလေး

ရာထူး... မြို့နယ်အုပ်ချုပ်ရေးမှူး

**သက်သေခံကတ်ပြားအမှတ်**

လက်မှတ်ပုံစံ



အလုပ်အကိုင် - ၃၂၈ မြို့မကျ

နေရပ်လိပ်စာ - သာယာဝတီ၊ ကျွန်း၊

ထိုးမြဲလက်မှတ် - မန္တလေး

မှတ်ချက်။ (အ) ခရီးသွားသည့်အခါ တစ်ပါတည်း ယူဆောင်သွားရမည်။

(၂) ပျောက်ဆုံး ပျက်စီးသည့်အခါ သက်ဆိုင်ရာ ပြည်သူ့ရဲစခန်း၊ မြို့နယ် လူဝင်မှုကြီးကြပ်ရေးနှင့် ပြည်သူ့အင်အား ဦးစီးဌာနမှူးရုံး ထံသို့ သတင်းပေးပို့ရမည်။

နိုင်ငံသားစိစစ်ရေးကတ်ပြား

ဖော်တို ၀၅၂၁၁၁

ရက်စွဲ ၁၁-၁-၁၉၈၈

အမည် စောနိုင်ကောင်းမြတ်ပိုင်

ဖခင်အမည် ဒေါ်ခင်စောနိုင်ခင်

မွေးသက္ကရာဇ် ၁၂.၁၂.၁၉၈၈

လူမျိုး/ဘာသာ ဗုဒ္ဓ/ဗုဒ္ဓဘာသာ

ထုတ်ပေးသူလက်မှတ် အရပ် ၅'၆" သွေးအုပ်စု 'B' +

အမည် စင်စူးသိန်းစာမတ်စာသား

ရာထူး ရဲမှူးမှူး

အမှတ်စဉ် N171682

သက်သေခံထုတ်ပြားအမှတ် နိုင်နုကောမွန်ကောလ်

အလုပ်အကိုင် ကျောင်းသား

နေရပ်လိပ်စာ အင်းကြာ၊ ရန်ကုန်

ထိမ်းမြားလက်မှတ် ၅ လမ်း၊ ဂွဗျာတောင်ကုန်းမြို့

အခြေအနေအထားရမည့်အားဖြင့်

၁။ ဖုတ်စီးသည့်အခါ သက်ဆိုင်ရာ ရဲစခန်း၊ မြို့နယ်လုပ်ငန်းကြွေးကြော်ရေး နှင့် အခြားသောမှတ်ပုံတင်ရေးဦးစီးဌာနမှူးများသို့ သတင်းပို့ရမည်။

၂။ ဤလက်မှတ်ကို အသက် (၁၇) နှစ်ပြည့်လျှင် လဲလှယ်ရမည်။ မှတ်တမ်းပါက အရေးယူခြင်းခံရမည်။



နိုင်ငံသားစိစစ်ရေးကတ်ပြား

အမှတ် ၁၂/သလဒ်(၁) ၀၀၇၅၃၆

ရက်စွဲ ၉ NOV 2017

အမည် မန္တလေးမြို့

အမည်စဉ် မိုးဆီရိုး

မွေးသက္ကရာဇ် ၁၄...၅...၁၉၇၇

လူမျိုး/ဘာသာ ကရင် + ဗမာ၊ ဗုဒ္ဓ

ထုတ်ပေးသူလက်မှတ် အရပ် ၂၂ သွေးအုပ်စု B

အမည်စဉ် ခင်မောင်သိန်း

တင်ရှားသည့်အမှတ်အသား ၁၂...၅...၃၆

ရာထူး လက်ထောက်

အမှတ်စဉ် AE 170284

သက်သေခံကတ်ပြားအမှတ်

လက်ခံလက်မပုံစံ

အလုပ်အကိုင် ကုမ္ပဏီအရာထမ်း

နေရပ်လိပ်စာ ပဲခူးတိုင်းဒေသကြီး

ထိုးမြဲလက်မှတ် သန့်ပျင်မြင့်

၁။ ဤကတ်ပြားကို အမြဲဆောင်ထားရမည်။

၂။ ပျောက်ဆုံး၊ ပျက်စီးသည့်အခါ သက်ဆိုင်ရာ ရဲစခန်း၊ မြို့နယ်လူဝင်မှုကြီးကြပ်ရေး နှင့် အမျိုးသားမှတ်ပုံတင်ရေးဦးစီးဌာနမှူးရုံးသို့ သတင်းပို့ရမည်။

၃။ ဤလက်မှတ်ကို အသက် (၄၅) နှစ်ပြည့်လျှင် လဲလှယ်ရမည်။ ပျက်ကွက်ပါက အရေးယူခြင်းခံရမည်။

တပ်မှူး ဦး (လ/သလဒ်(၁) ၀၀၇၅၃၆)



**Info Myanmar University (IMU)**

# **Info Myanmar University Profile**





# Info Myanmar University Your Trusted Education Provider

(2014 ~ 2019 Profile)



## Our Partners:







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## **Vision**

- Transforming lives and communities through learning

## **Mission**

- To educate and nurture students with critical and creative thinking and problem solving
- To nurture the qualified IT professionals to be served in our community and beyond
- To develop future leaders of our nation

## **Values**

- Innovation
- Life-long learning
- Communication and Community



# WELCOME TO INFO MYANMAR UNIVERSITY (IMU)

## SUCCESS IN EDUCATION SECTOR SINCE 2007

- IMU, the computing arm of IMCS Co., Ltd. which achieved the success in the International ICT certification courses since 2007, was established in 2014 with the strong commitment to firmly pillar the educational requirements of the age of knowledge-based society through transforming digital economy in Myanmar.
- We aim to become one of the prestigiously disciplined private computing universities in Asia addressing the ever-changing needs of the state-of-the-art technology with qualified education. Our ultimate aim is not only to nurture the young minds and bring out the best in them to become the smart future skilled and talented employees excelling in their chosen profession with high capacity in working and dealing with unavoidable and undesirable circumstances but also to cultivate the willingness of contribution to the community.
- IMU has proudly stood as a private computing college which successfully produces future IT leaders with a strong constitution of admin staff and highly professional teaching academics.
- Our students and senior students who are currently in the work place are the testament to what we have committed to build a better nation from the educational sector.
- We proudly welcome the students whose zealous ambition is to transform lives of community with their globally recognized qualification addressing the demands of digital economy in local and abroad.







# THE CITY OF YANGON MYANMAR

## Yangon

One of the best places in Asia is Yangon, Myanmar largest city.

- Nature lovers will surely appreciate the city's stunning lakes, shady parks and verdant tropical trees.

- Yangon was founded in 1755 by King Alayngpaya who named Yangon, meaning "End of Strife".

- This city is a melting pot- a diversity of cultures and communities in terms of people, settlement and religions.

- Yangon is the commercial heart of the country and the largest city, with a population of six millions.

- The most famous landmark in Yangon is the Shwe Dagon Pagoda which itself is a solid brick stupa that is completely covered with gold.

- Yangon is the site of several other major religious edifices including Sule(world peace pagoda )and Botahtaung pagoda.

- North of the city Centre is Royal Lake (Kandawgyi) surrounded by a wooden park nearby are the city's zoological botanical garden.Bogyoke Aung San Museum and the National Museum If Art and Archaeology are a must to visit and there are some stadiums for sports and athletic events.

- Yangon is Myanmar's main Centre for trade and handles more than 80% of the country's foreign commerce.

- It is also the center of national rail, river, road and air transportation.









# OUR HISTORY



**2007**



## About IMC

Info Myanmar College is an academic education branch of IMCS Computer Training Centre, IMCS Co., Ltd. founded in 2007.

**2014**



Info Myanmar College was established in 2014 and it is one of the leading private colleges to keep abreast of the global Information and Communication Technology in Yangon, Myanmar.

**2015/16**



**Pearson**

Info Myanmar College is the approved center of Pearson Education, UK to provide Higher National Diploma Program.





## 2017

Edinburgh Napier  
UNIVERSITY

Info Myanmar College has successfully started a bachelor degree, B.Sc (Hons) Computing in partnership with Edinburgh Napier University, UK in 2017.

## 2018

IMC has successfully produced many IT professionals whose role is the vital importance in the developments of the nation. B.Sc computing class is taught by both world-class lecturers from Edinburgh Napier University and IMC lecturers.

## 2019

Currently, there are over (200) students in IMC. To provide the higher computing modules in Myanmar, IMC starts to deliver M.Sc in Advanced Security and Digital Forensics which is globally recognized by Edinburgh Napier University in UK.





## **ABOUT OUR PARTNER EDINBURGH NAPIER UNIVERSITY**

- Edinburgh Napier is in the top five percent of universities worldwide, according to The Times Higher Education World University Rankings.
- Edinburgh Napier has been awarded the Queen's Anniversary Prize twice in 2009 and 2015 for Higher and Feature Education
- Edinburgh Napier University receives five stars for teaching, employability and internationalization by the QS Stars international university rankings.
- Edinburgh Napier University is based around its three main Edinburgh campuses: Merchiston, Craiglockhart and Sighthill. It has over 20,000 Students, including those on-campus in Scotland and others studying on transnational programmes abroad and online.
- Over 95% of Edinburgh Napier University graduates are in work or further study within six months of graduating.



# PROGRESSION PATHWAY

# PROGRAMME

## INFO MYANMAR UNIVERSITY

MASTER'S DEGREE



Advanced M.Sc (Advanced Security & Digital Forensics)

BACHELOR'S DEGREE



B.Sc (Hons) Computing

HIGHER NATIONAL  
DIPLOMA



QCF - HND in Computing  
RQF - HND in Computing

- HND in Computing (Network Engineering)
- HND in Computing (Software Engineering)
- HND in Computing (Data Analytics)
- HND in Computing (Security)
- HND in Computing (Intelligent Systems)
- HND in Computing (Applications Development)

HIGHER NATIONAL  
CERTIFICATE



Pre HND Certificate

FOUNDATION  
CERTIFICATE



LOCAL MATRICULATION  
EXAM or GCE-A LEVEL  
or BTEC Level 3



# PROGRAM STRUCTURE



## Higher National Diploma (HND)

Pearson BTEC Higher Nationals are designed to help students secure the knowledge skills and behaviours needed to succeed in the workplace. They represent the latest in professional standards and provide opportunities for students to develop behaviours for work.

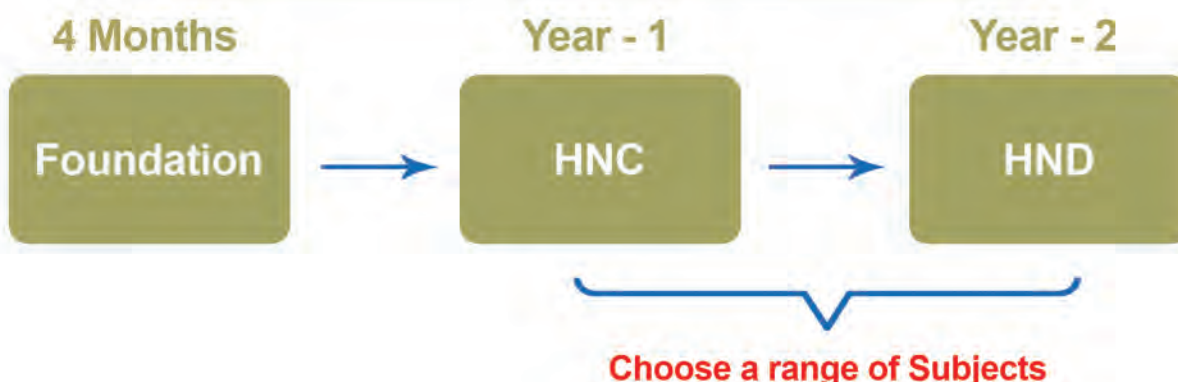
At the same time the BTEC Higher Nationals are intended to keep doors open for future study should a student wish to progress further in their education after their level 5 study.

The Pearson BTEC Higher Nationals address these various requirements by providing: A range of core, optional and specialist units, each with a clear purpose, so there is something to suit each student's choice of programme and future progression plans.

### Diploma Structure

#### A DIPLOMA OF CHOICE

- QCF - HND in Computing
- RQF - HND in Computing
  - HND in Computing (Network Engineering)
  - HND in Computing (Software Engineering)
  - HND in Computing (Data Analytics)
  - HND in Computing (Security)
  - HND in Computing (Intelligent Systems)
  - HND in Computing (Applications Development)







## B.Sc (Hons) Computing Degree

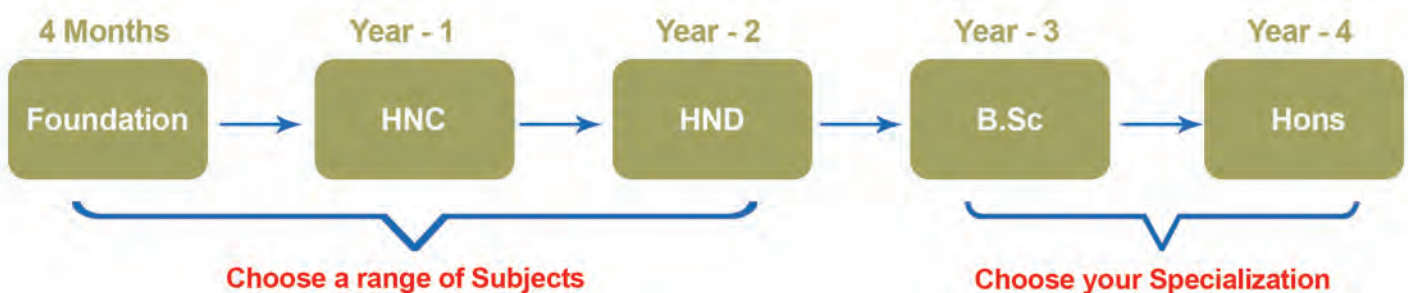
B.Sc Computing is specifically designed to give students the right professional skills that they will find useful in the digital economy.

This degree focuses on Software Development or Networking with Cyber Security.

Our Cybersecurity & Forensics course is certified by the National Cyber Security Centre (NCSC) - the first undergraduate course in the UK to achieve this.

### Degree Structure

#### B.Sc (Hons) Computing





## M.Sc (Advanced Security & Digital Forensics)

This M.Sc course is designed to gain foundation knowledge in all the key areas of cybersecurity, both defensive and offensive, as well as post-incident response and malware analysis.

The digital forensic aspects of the course include network and computer forensics, allowing learners to develop the knowledge required to conduct computer-related investigations across networks, systems, and other digital devices.

Course specialisms include network security, penetration testing, incident response, malware analysis, cryptography, audit and compliance, and host and mobile digital forensics. The specialisation gain in the taught modules is further developed through an extensive research-based MSc dissertation project, leading towards a mastery of a subject area and enhancing particular specialism.

### Master Structure

#### M.Sc (Advanced Security & Digital Forensics)



# PROGRAMME ENTRY REQUIREMENTS AND ADMISSIONS



## HIGHER NATIONAL DIPLOMA (HND)

Although Pearson do not specify formal entry requirements, as a centre it is your responsibility to ensure that the students you recruit have a reasonable expectation of success on the programme.

For students who have recently been in education, the entry profile is likely to include one of the following:

- A BTEC Level 3 qualification in Computing
  - A GCE Advanced Level profile that demonstrates strong performance in a relevant subject or adequate performance in more than one GCE subject.
- This profile is likely to be supported by GCSE grades at A\* to C (or equivalent)
- Other related Level 3 qualifications
  - An Access to Higher Education Certificate awarded by an approved further education institution
  - Related work experience
  - An international equivalent of the above.

## B.Sc (Hons) COMPUTING

To enter this Program at the start of year 3

- A BTEC Higher National Diploma in Computing with a Networking or Software development specialism studied at Info Myanmar College
- Or a BTEC Higher National Diploma in Computing with a Networking or Software development specialism from a Pearson Edexcel accredited institution or an equivalent qualification subject to the discretion of the programme leader.
- And English language skills with IELTS 4 skills overall score (6.0) or TOEFL 4 Skills overall score 80 or Pearson's Test of Academic English\_Versant Test overall score 56 or Cambridge English Proficiency (CPE)/ Cambridge English First (FCE)/ Cambridge English Advance(CAE) overall score 169





## M.Sc (ADVANCED SECURITY & DIGITAL FORENSICS)

Students will be eligible to apply if they have gained one of the following qualifications:

- Bachelor (Honours) (4 years) professional or non-professional with 70% or above OR 60% or above with two years relevant work experience
- Bachelor in professional subjects (5+ years) at 60% above
- Postgraduate diploma (+ any bachelor degree) at 60% above

If your first language is not English, we may ask you to provide evidence of your English language abilities when you apply to study at Edinburgh Napier University.

## MINIMUM ENGLISH LANGUAGE REQUIREMENTS

When you apply to study with us, we may ask you to undertake an approved language test to demonstrate your level of competency in English.

## EXEMPTIONS

You may not require an English language test if:

- You have completed your high school qualifications in English, or;
- Your bachelors degree was taught and examined in English.





# OUR ACTIVITIES

MYANMAR TRADITIONAL WATER FESTIVAL (THINGYAN)





# OUR ACTIVITIES

FUN ACTIVITIES

(CHRISTMAS PARTY, NEW YEAR PARTY & KING & QUEEN CONTEST)





# OUR ACTIVITIES

## OFFERING KAHTAIN ROBES





# OUR ACTIVITIES

## ANNUAL PAYING HOMAGE CEREMONY





# OUR ACTIVITIES

SIGHTSEEING TO YANGON





# OUR ACTIVITIES

GOING ON LONG TRIPS TO GET IN TOUCH WITH CULTURE AND  
CUSTOM OF EACH LOCAL SITE





# OUR ACTIVITIES

PARTICIPATING IN INTER-COLLEGE FOOTBALL MATCH





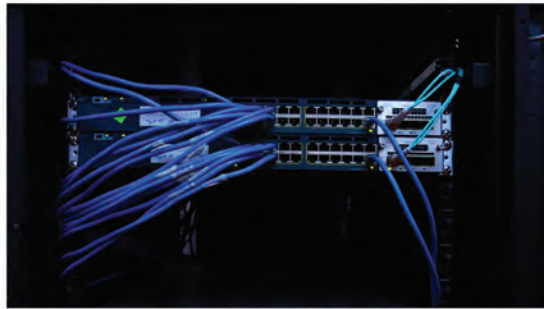
# OUR ACTIVITIES

## MOVEMENTS IN IMC FUSEL FOOTBALL MATCH





# OUR FACILITIES



1. 700 laptops are provided for the whole college.
2. E-book reader is given each for all the students.
3. Students have an access to Free WiFi and a library which has thousands of books.
4. The school provides a large cozy lobby as a recreational spot.
5. The hostels are provided for the students from the different regions of Myanmar.
6. Different culture and custom can be exchanged as students are from the different regions in Myanmar.





# INTERVIEW

With HEIN HTET KYAW

Hello, I'm Hein Htet Kyaw from Info Myanmar College. I've just graduated a Bachelor of Science Degree from Edinburgh Napier University and HND Diploma.

I chose Computing subject as my professional career just to fulfill my passion and flow my curiosity on it. Although there are many useful carriers in this emerging market of Myanmar, I believe Computing is a profession that plays a vital role in transforming our economy to digital economy.

There are many colleges to study Computing in Myanmar. Despite of all others, I chose Info Myanmar College and I am pretty sure I made the right choice. While I was studying in IMC, I was taught by the teachers who are morally and professionally qualified.

With my BSc Computing, I am considered to be eligible for studying my Master Degree at James Cook University with a partial scholarship. My previous studies at Info Myanmar College have helped me a lot while building my confidence in English because of the foreign visiting lecturers from Edinburgh Napier University.

I'd like to suggest my juniors from Info Myanmar College to attend BSc Top up BSc Program at the Info Myanmar College. You'll be trained enough to enter the labour force of our country.

I'd also like to thank to Info Myanmar College for providing me many opportunities and helps. Good luck to you all and have an nice day.



# STUDENT SUCCESS STORY



“ I feel that I am quite ready to start my career just after B.Sc Computing as I am well equipped with necessary skills, as a software engineer, such as team spirit, presentation skill by doing group projects. ”



“ What I have learnt for B.Sc Computing is really applicable and effective in the work place outside. ”



“ I have got not only International experience but also academically technical skill from World Rank Lecturers of Edinburgh Napier University. ”



“ It is my source of pride to have practically used CISCO equipments. ”



“ I am into network security. What IMC teaches includes both defense and attack in Security and this made me more interested in Network Security. ”



“ The skill of task management and time management has been achieved by managing to complete the coursework assignment by deadline. So, I am ready to start my career. ”





“ I am very confident to step in the real workplace now because I have thoroughly learnt not only OS of Microsoft about server but Linux system as well. ”



“ Teaching learning process of IMC runs smooth with the systematic rules and regulations. We were trained to get both the theoretical knowledge and real-life experience through coursework for software development. I have a fervent intention to build my own software house. ”



“ Though IMC mainly focuses on computing subjects, English classes are also reinforced. Thanks to this, I have achieved Band 7.0 in IELTS. ”



“ I was trained in HND by well-experienced teachers who are academically smart and truly benevolent. This convinced me that I would be able to learn more in B.Sc(Hons). ”

# GRADUATION EVENT







**Info Myanmar University**

# **STRATEGIC PLAN**

(2019 ~ 2024)

## Vision

To be a top ranked computing university in Myanmar and ASEAN

## Mission

Providing the qualified teachers and skillful technicians with the high ability of handling the state-of-the-art technologies to fulfill every student's goal



## Key Objectives for 2024

- To be a quality education and an excellent university
- To be a research based university
- To develop the society by solving real-world problems through university-industry collaboration
- To support the resources and to be financial stability
- To acquire the student exchange program in order to get the international experiences
- To construct the strong partnership with local and regional levels in order to increase our cultural, societal and economic impact
- To undertake research or gain work experience abroad
- To contribute the appropriate CSR programs for developing society and culture

We set up the five strategies to accomplish the key objectives within the specific period.



## **(1) Education**

Our aims are to be a top ranked computing university in Myanmar and ASEAN and to provide a quality education that foster students with the values, skills and ethics to align with community needs and professional opportunities. To be a quality education and an excellent university, we have to make good strategic plan to strengthen the education system. So, we will:

- Recruit and support the qualified teachers and outstanding students at all levels to maintain our intellectual strength
- Plan to launch the postgraduate programs with specialized pathways within one year
- Provide the additional specialized pathways in undergraduate programs
- Provide the funding to offer the outstanding student award and the best teaching award to promote the students' and teachers' abilities
- Review annually all courses to be compatible with current technology trends
- Provide opportunities, through and outside the curriculum, for our students to develop the personal and transferable skills to succeed in local and global workplaces
- Provide the funded internships, work placement opportunities in Myanmar and overseas and career preparation for all our students.

## **(2) Research**

Our researches aim to develop the society by solving real-world problems through university-industry collaboration and the scope of doing researches aims to nurture researchers, innovators and creators. To be a research based university, we will:

- Launch the research and innovative department.
- Support a proper environment for conducting research with appropriate facilities and infrastructure for staff and students and invest in training for our staff.
- Carry out the effective research for solving real problems.
- Collaborate with international universities and organizations for doing research.
- Provide the research fund to emerge the best research and try to get the research fund.
- Motivate the staff to find the research fund.
- Encourage the faculty members to produce their own conference papers and journals.





### (3) Resources and Financial Stability

The effective control of the resources supports all the aspirations of our university and so resources and financial stability play a vital role to be a sustainable development of education sector.

People are the vital resources of the university's success and the quality of academic and support staff is critical for the achievement of our strategic goals. In order to ensure that IMU stands as a top ranked computing university in Myanmar and ASEAN, we have to continue to:

- Recruit and retain the qualified staff
- Provide health and wellbeing of our staff and create a practice environment that is supportive of wellbeing
- Encourage academic and support staff to participate in planning their personal development and capacity building to be effective in management and leadership responsibilities
- Promote the staff facilities according to their performance and responsibilities.

Adequate infrastructures are needed to be a proper environment in the university. Our university aims to:

- Refurbish and renew the existing estate
- Design flexibly the new buildings that intend to meet the International standards of accessibility and environmental Sustainability



- Provide the school ferry for staff and students to travel sustainably around the housing and university campus
- Promote the high speed Internet access for all staff and students
- Promote to deliver additional accommodation for staff and student housing programme
- Invest in ICT Tools usage in order to increase research capacity, enhance teaching and learning environment and facilitate the administrative functions

We will properly/actively manage/control all the investment, income and expenditure in a responsive way/ manner (which enables the university to reach effectively to any changes in the external funding/environment). To be the university's financial sustainability, we will:

- Set up good strategic marketing plan to get the target revenue.
- Monitor and evaluate departments' budgets for cost-effective operations.
- Collect and review annual financial report, including revenue and expenditure from all departments.
- Perform regular reviews of activity and workflow analysis.



#### **(4) Engagement & Partnership**

We will carry out to acquire the student exchange program in order to get the international experiences. We will support and expand international mobility opportunities for staff and students to study, undertake research or gain work experience abroad. We will expand strategic international research collaborations. We will collaborate with international organizations for holding conference, training and workshop. We will construct the strong partnership with local and regional levels in order to increase our cultural, societal and economic impact.



#### **(5) Corporate Social Responsibility**

Our aims are to support the development of the society, education industry and culture in Myanmar. In order to successfully contribute to sustainable development, we are committed to:

- Provide tech-talk, seminar and forum to the public aiming for the development of Information Communication Technology.
- Provide grant aid where necessary to reduce the drop-out rate in middle and high schools.
- Support public healthcare and wellbeing by donating the clinical equipments, medicines and nutriment for Government Hospitals.
- Provide the monastic necessity for the propagation of the Buddhism.



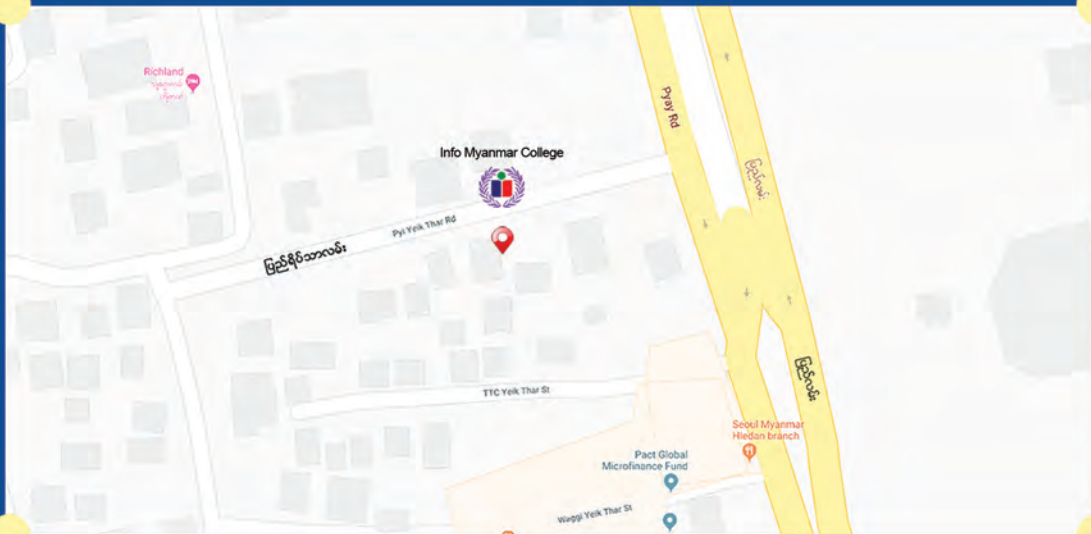
# FIND US

Our main campus is in Yangon in the South of Myanmar.



TRAVEL TIMES	
Destination	Bus
Mandalay	8 hr 8 min
Taunggyi	10 hr 18 min
Napyitaw	5 hr 10 min
Bago	2 hr 0 min
Pathine	4 hr 27 min
Mawlamyaing	6 hr 1 min
Myeik	16 hr 37 min

[www.infomyanmarcollege.edu.mm](http://www.infomyanmarcollege.edu.mm)



လိပ်စာ

## Main Campus

အမှတ်(၅၀၇/၇)၊ ပြည်လမ်း၊ ကမာရွတ်မြို့နယ်၊ ရန်ကုန်မြို့။

## Windermere Campus

အမှတ်(၃၉/၄၀)၊ အောင်မင်းခေါင်လမ်း၊ (၁၀) ရပ်ကွက်၊ ဝင်းဒါယာ၊ ကမာရွတ်မြို့နယ်၊ ရန်ကုန်မြို့။

## ဆက်သွယ်ရန်ဖုန်းနံပါတ်

ဖုန်း - ၀၁ ၅၃၆၅၆၄ ၊ ၀၁ ၅၁၂၁၁၉ ၊ ၀၉ ၄၅၀၀၈၇၀၉၈ ၊ ၀၉ ၄၄၅၄၆၀၄၈၃ ၊ ၀၉ ၄၅၀၀၉၇၇၂၁

## CONTACT US

Admissions Enquiries : Info Myanmar University (Main Campus)  
 Address : No. 507/7 Pyay Road, Kamayut Tsp, Myanmar  
 Ph No : 01-536564, 01-512119, 09- 450087098, 09 445460483  
 Hot Line : 09-420264796, 09-450097721

 [www.infomyanmarcollege.com](http://www.infomyanmarcollege.com)  
 [www.facebook.com/infomyanmarcollege](https://www.facebook.com/infomyanmarcollege)  
 [admin@imcscompany.com](mailto:admin@imcscompany.com)





**Info Myanmar University (IMU)**

# Founder's Profile



## Info Myanmar University



**Daw Nu Nu Thant  
Founder  
&  
Managing Director**

- Daw Nu Nu Thant, Founder and Managing Director of Info Myanmar College (IMC) was born on 13<sup>th</sup> July 1977 in Yangon.
- As the founder of IMC, with the great inspiration of shaping Myanmar education better, she makes all out her efforts to be the most prestigious disciplined private computing university in Myanmar.
- She graduated B.Sc (Botany) from Dagon University in 2003 while she had been properly setting up Nay La Clinic since 1998.
- She never fails to devote the time for self-development with continuous study in language, strategic management and leadership skills starting from 2003.
- Targeting to academically support Industry Change and to nurture IT professionals, IMCS Co., Ltd. which is delivering international ICT certification courses as the educational service provider with start-up in the educational field was founded at Yangon in 2007. Her efforts resulted in producing over 7000 IT Technicians.
- At the same time, she continued to study Business Management and she achieved Advanced Diploma in Business Management awarded by ABE-UK in 2010.
- With her successful achievement in IMCS Co., Ltd. for eight years in 2014, she was determined to set up further IT industry with the foundation of Info Myanmar College which can serve the development of the nation through producing qualified IT professionals in Yangon.





- She can drive successfully since she has set up IMC as the Pearson, UK approved computing college. As she is truly passionate about the improvement of IMC's teaching-learning process, it is the great pride for her to have brought B.Sc (Hons) Computing Programme in 2017 and Master Programme in 2019 in Partnership with Edinburgh Napier University.
- Furthermore, it is quite fulfilling for B.Sc (Hons) students to have been trained by visiting lectures and professors from Edinburgh Napier University, UK together with qualified IMC academic faculty members.
- Currently, there are over 500 students who are studying the higher computing modules with 26000 square feet's in IMC campus.
- With the investment of 1 million dollars, there is Windarmiyar campus which will develop in 2019-2020 with excellent infrastructure that can fulfill the international standard and can hold 500 students.
- She endeavors to build the better future of Myanmar as the role of education because she believes through learning can transform lives and community.
- Not only she emphasizes the continuous progress of students but also values the capacity building of academic staff by giving training for languages and professional development with experts from local and abroad.
- Moreover, she is very keen to create a proper teaching-learning environment for both lecturers and students as well as creating peer environment for lecturers and staff in IMC.
- To build and manage properly IMC, she is studying the area of strategic leadership and management in education. At Present, she is also a Master candidate of Leadership and Management in Education, University of Newcastle, Australia.
- To study and to get exposure the nature of foreign university, she visited Singapore and UK. Moreover she participated as one of the members of Myanmar Business Delegation to UK in 2017 and 2018.
- Being the founder of IMC, as she is eagerly to share her experience to students, she is often teaching a few modules, the area of management in Diploma level.
- As she with great concerns and zealousness in the development of the society, education industry and culture in Myanmar, she is the great one who contributed through variety of providing financial supports, about (3000) lakhs since she set up IMCS Co., Ltd. in 2007.
- As the great attention of IMC is to support the development of youth, IMC proudly supported Myanmar Future Leaders 2019 held in Mandalay in May 2019.



## Info Myanmar University



**Daw Nu Nu Thant**

**Founder &  
Managing Director**

### Personal Details

Address	: No. 39/40, Aung Min Khaung Street, Windarmieyar, Kamayut Township
Contact No.	: +959-259580005
Email	: admin@imcscompany.com
Date of Birth	: 13 <sup>th</sup> July 1977

### Education and Qualifications

Title	: B.Sc.(Botany)
Awarding Organisation	: Dagon University, Myanmar
Duration	: 1998-2003
Title	: Advanced Diploma in Business Management
Awarding Organisation	: Association of Business Executive (ABE-UK)
Duration	: 2007-2010
Title	: Certificate of Micro Master Program, Developing Your Educational Leadership and Management Vision
Awarding Organisation	: Newcastle, Australia
Duration	: March 2019
Title	: Certificate of Micro Master Program, Leading Transformative Change in Education
Awarding Organisation	: Newcastle, Australia
Duration	: April 2019





Title	: Certificate of Micro Master Program, Applying Strategic Leadership in Education
Awarding Organisation	: Newcastle, Australia
Duration	: April 2019
Title	: Master candidate of Leadership and Management in Education, University of Newcastle, Australia.
Awarding Organisation	: Newcastle, Australia
Duration	: May 2019
Title	: Certificate of Change Management
Awarding Organisation	: Singapore Institute of Management, SIM
Duration	: 2018
Title	: Certificate of Basic Diplomatic Skill
Awarding Organisation	: Ministry of Foreign Affairs
Duration	: January to April 2008

### Industrial and Commercial Experiences

Name of Organisation	: Nay La Clinic
Position	: Founder & Managing Director
Duration	: 1998- 2003
Name of Organisation	: IMCS Computer Training Center, IMCS Co, Ltd;
Position	: Founder & Managing Director
Duration	: 2007- Present
Name of Organisation	: Info Myanmar College, IMCS Co, Ltd;
Position	: Founder & Managing Director
Duration	: 2014- Present
Name of Organisation	: HM Technologies, HM Co, Ltd;
Position	: Founder & Admin Director
Duration	: 2015- Present

### Teaching Experiences

Position	: Lecturer, Info Myanmar College
Module	: Employability and Professional Development
Level	: Level- 4, QCF, Pearson UK
Duration	: 2015-2016
Position	: Lecturer, Info Myanmar College
Module	: Professional Practice
Level	: Level- 4, RQF, Pearson UK
Duration	: 2018-Present



**Info Myanmar University (IMU)**

လိုင်စင်၊ စာချုပ်စာတမ်း မိတ္တူများ





# ကမ္ဘာ့မဏ္ဍိုင်ပုံစံလက်မဏ္ဍိုင်

## Certificate of Incorporation

အိတ် အမ် စီ အက်စ် (အင်စတီကျုရှင်းနုမန့် ကွန်ပျူတာ စတာတီ) ကမ္ဘာ့ လီမိတက်  
IMCS (INSTITUTE OF MANAGEMENT & COMPUTER STUDIES) COMPANY LIMITED  
Company Registration No. 103990572

မြန်မာနိုင်ငံကမ္ဘာ့မဏ္ဍိုင်များအက်ဥပဒေ ၁၉၁၄ ခုနှစ် အရ  
အိတ် အမ် စီ အက်စ် (အင်စတီကျုရှင်းနုမန့် ကွန်ပျူတာ စတာတီ) ကမ္ဘာ့ လီမိတက်  
အား ၂၀၁၃ ခုနှစ် ဇန်နဝါရီလ ၇ ရက်နေ့တွင်  
အစည်းအရုံးအားဖြင့် တာဝန်ကန့်သတ်ထား သည့် အများပိုင်သက်ဆိုင်သောကမ္ဘာ့  
အဖြစ် ဖွဲ့စည်းမဏ္ဍိုင်ပုံစံခွင့် ပြုတော်မူသည်။

This is to certify that  
IMCS (INSTITUTE OF MANAGEMENT & COMPUTER STUDIES) COMPANY LIMITED  
was incorporated under the Myanmar Companies Act 1914 on 7  
November 2013 as a Private Company Limited by Shares.

ကမ္ဘာ့မဏ္ဍိုင်ပုံစံအရာရှိ

Registrar of Companies

ရင်းနှီးမြှုပ်နှံမှုနှင့်ကမ္ဘာ့မဏ္ဍိုင်များစီမံကိန်းဌာန

Directorate of Investment and Company Administration



Former Registration No. 3819/2013-2014



## Myanmar Companies Online Registry - Company Extract

### Company Name (English)

IMCS (INSTITUTE OF MANAGEMENT & COMPUTER  
STUDIES) COMPANY LIMITED

### Company Name (Myanmar)

.....  
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### Company Information

<b>Registration Number</b>	<b>Registration Date</b>	<b>Status</b>
103990572	07/11/2013	Registered
<b>Company Type</b>	<b>Foreign Company</b>	<b>Small Company</b>
Private Company Limited by Shares	No	No
<b>Principal Activity</b>	<b>Date of Last Annual Return</b>	<b>Previous Registration Number</b>
-	-	3819/2013-2014

### Addresses

Registered Office In Union	No .7 ,Pyay Yeik Thar Street KAMAYUT TOWNSHIP YANGON, Myanmar 11041
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### Officers

Name:	KAUNG MYAT PAI	Type:	Director
Date of Appointment:	N/A	Date of Birth:	11/06/1980
Nationality:	Myanmar	N.R.C./Passport:	12/KAMAYA(N)052111
Gender:	Male	Business Occupation:	-
Name:	NU NU THANT	Type:	Director
Date of Appointment:	N/A	Date of Birth:	13/07/1977
Nationality:	Myanmar	N.R.C./Passport:	11/YABANA(N)049277
Gender:	Female	Business Occupation:	-

### Ultimate Holding Company

<b>Name of Ultimate Holding Company</b>	<b>Jurisdiction of Incorporation</b>	<b>Registration Number</b>
INSTITUTE OF MANAGEMENT AND COMPUTER STUDIES	Myanmar	3819/2013-2014

### Share Capital Structure

<b>Total Shares Issued by Company</b>	<b>Currency of Share Capital</b>
1,000	MMK

Class	Description	Total Number	Total Amount Paid	Total Amount Unpaid
ORD	Ordinary	1,000	100,000,000.00	0.00

### Members

Name of Company:	INSTITUTE OF MANAGEMENT AND COMPUTER STUDIES
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## Myanmar Companies Online Registry - Company Extract

### Company Name (English)

IMCS (INSTITUTE OF MANAGEMENT & COMPUTER  
STUDIES) COMPANY LIMITED

### Company Name (Myanmar)

အိုင် အမ် စီ အက်စ် (အင်စတီကျုမန်နေမန် ကွန်ပျူတာ စတာတီ) ကုမ္ပဏီ  
လ

Registration Number: 3819/2013-2014 Jurisdiction of Incorporation: Myanmar

Class	Description	Total Number	Total Amount Paid	Total Amount Unpaid
ORD	Ordinary	500	50,000,000.00	0.00

Name: KAUNG MYAT PAI  
Gender: Male Date of Birth: 11/06/1980  
Nationality: Myanmar N.R.C./Passport: 12/KAMAYA(N)052111

Class	Description	Total Number	Total Amount Paid	Total Amount Unpaid
ORD	Ordinary	50	5,000,000.00	0.00

Name: NU NU THANT  
Gender: Female Date of Birth: 13/07/1977  
Nationality: Myanmar N.R.C./Passport: 11/YABANA(N)049277

Class	Description	Total Number	Total Amount Paid	Total Amount Unpaid
ORD	Ordinary	450	45,000,000.00	0.00

### Mortgages and Charges

Form / Filing Type Effective Date

No records available

Details about all mortgages and charges can be accessed from the Company Profile Filing History at no charge.

### Filing History

Form / Filing Type Effective Date

C-3 | Change to share capital or register of members 15/05/2019

B-1 | Application for re-registration of a private company limited by shares 12/09/2018



# AYA Bank

အမှတ်တံဆိပ်

Your Trusted Partner

TO

0167-1-03-01-000064-3

/ IMCS (INSTITUTE OF MANAGEMENT & COMPUTER STUDITES) CO.,LTD  
/DAWNUNUTHAN/

3819/20132014/11/RABHANA(N)049277

Dear Sir/Madam,

We hereby certify that the balance standing at the Credit of the account of / IMCS (INSTITUTE OF MANAGEMENT & COMPUTER STUDITES) CO.,LTD/Daw NU NU THAN /3819/20132014/11/RABHANA(N)049277 A/C no. 0167-1-03-01-000064-3 with the AYEYARWADY BANK at the close of business on the 09/05/2019 (03:09 PM) was K : 300,358,822.25 ( Three Hundred Million Three Hundred Fifty-Eight Thousand Eight Hundred Twenty-Two Kyat And Twenty-Five Pya ).

Yours faithfully,

(Manager)

ACCOUNTS DEPARTMENT

Manager

Ayeyarwady Bank Limited

Union Square Br

Head Office : Yangon, Myanmar

No.416, Corner of Mahabandoola Road  
& Mahabandoola Garden Street, Kyauktada Township.

Block No.(3/B), Quarter No-23(G-1)  
Corner of Strand Road & Thit Taw Road,  
River View Point Condominium, Ahlone Township

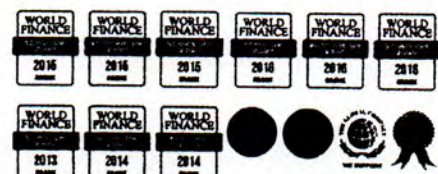
T +951 370500

F +951 370501

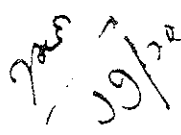
E info@ayabank.com.mm

www.ayabank.com

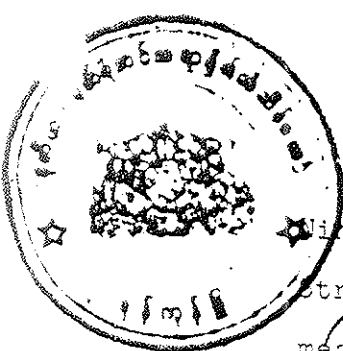
f www.facebook.com/ayabank







**အုပ်စုချုပ်ရုံးမှတ်ချက်များကို စာချက်နံ** .....  
.....ထပ်ကြည့်ပါ။  
*[Signature]*  
**အုပ်စုချုပ်ရုံးမှတ်ချက်များ**

[illegible]

WHEREAS by virtue of an Indenture dated the 20th day of June, 1955, executed by the Indian Hume Pipe Co., Ltd., (a company registered under the Indian Company Act, 1913, having its registered Office at Construction Home, Ballard Estate, Fort Bombay, India) through its duly constituted Agent and Attorney Mr. Kantilal Balubhai Mehta of the Scindia Steam Navigation Co., Ltd., Rangoon, in favour of U Thain Khin and duly registered in the Office of the Sub-Registration of Rangoon, in Book No. Volume 118 and pages 228 & 229 being No.1090 dated 29th June, 1955, the above Vendor has become the absolute owner of the land, now intended to be conveyed and more specifically and particularly described hereinafter in the Schedule.

WHEREAS the Vendor being the sole and absolute owner of the land more fully and particularly described in the Schedule hereunder written. AND AS SUCH, he the Vendor having good right and title to convey, transfer and assign, has agreed with the Purchaser for the absolute sale to him of the said land fully described in the Schedule hereunder written: FREE FROM ALL ENCUMBRANCES at or for the price of Kyats Twenty Thousand only.

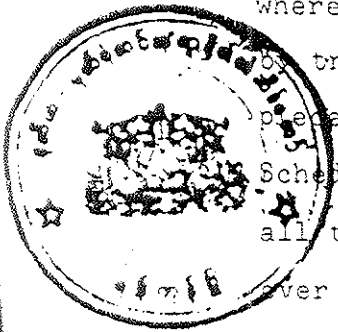
AND WHEREAS the Purchaser had on the ~~20th~~ day of ~~September~~, 1955, paid a sum of K.1,000/- (Kyats One Thousand only) to the Vendor towards the aforesaid consideration (for which a separate receipt has been given) and has on this <sup>25th</sup> ~~20th~~ day of October 1955, paid the balance of K.19,000/- (Kyats Nineteen Thousand only) in full settlement of the price of the said land fully described in the Schedule hereunder written.

NOW THIS INDENTURE WITNESSETH that in pursuance of the said agreement and in consideration of the sum of K.20,000/- (Kyats Twenty Thousand only) paid this day by the Purchaser to the Vendor in full amount (the receipt whereof the Vendor doth hereby admits and acknowledges) the Vendor does hereby transfer, grants, assigns and conveys unto the said Purchaser all that piece or parcel of the said Land more particularly and fully described in the Schedule appearing hereunder AND ALL the legal and usual appurtenances, and all the estate, right, title, interest, claims, actions and demands whatsoever of the Vendor in to or upon the said land hereby granted or conveyed so to be unto the use of the Purchaser absolutely and forever:-

AND the Vendor hereby covenants with the Purchaser that notwithstanding anything by the Vendor done, committed or knowingly suffered to the contrary, the Vendor now has a good right and title to grant and convey the property described in the Schedule hereto, together with all rights, easements and appurtenances hereto belonging, unto the use of the said Purchaser in the manner aforesaid, and that free from all encumbrances:

AND further that henceforth the Purchaser shall be the rightful and absolute owner of the said property, and peacefully and quietly HAVE HOLD and occupy and possess the same, and enjoy the rents, profits, benefits and emoluments thereof without any let, claims, demands, hindrances interruptions or eviction by the Vendor, or any person or persons claiming under him:

AND the Vendor will always keep the Purchaser secured, harmless and indemnified against all losses and detriments occasioned to or suffered by the Purchaser owing to any claims, suits or demands made or preferred by any one in respect of the said property or any part thereof, and that the Vendor and every person having or lawfully or equitably claiming any estate right title or interest in or to the said property or any part thereof from under or in trust for the Vendor, shall make good the same, and will from time to time and at all times at the request and cost of the Purchaser do, execute and register or cause to be done, executed and registered all such acts or deeds or assurances for further and more perfectly assuring all or





any of the said property unto the Purchaser in the manner aforesaid, and they shall or may be reasonably satisfied.

SCHEDULE OF PROPERTY.

ALL THAT PIECE OR PARCEL of Freehold Land (as shown in red on the attached plan) known as plot No.7, on a portion of Allotment Nos. 7, 8, 9 & 10, Block No.82, Kemmendine East and Thayer Circle, at No.505 - 507, Prome Road, Rangoon, measuring 100' x 130' 0" 30" of an acre or thereabout, bounded on the North by 98' wide private road way

On the East by Plot No.6

On the South by Tan Ma Shwe Zin's property

On the West by Plot No.8



IN WITNESS WHEREOF the Vendor has hereunto set his hands at Rangoon on the day month and year first above written.

IN THE PRESENCE OF:-

Khi Thun Myint, B.A.B.L.

Advocate.

25/10/55.

U. S. O. U. Shwe Yami  
25.10.55  
1092 Supt. Hds

*Handwritten signature and date 25/10/55*  
Vendor



40.90  
10.90





PLAN SHOWING THE PROPOSED LAY-OUT  
OF FREE-HOLD LAND AT HOLDING NOS. 7, 8, 9 & 10 BLOCK B2,  
KEMMENDINE EAST & THAYETKON CIRCLE  
KNOWN AS. NR 505-507 PROME RD. RANGOON.

HOLDING NO.	AREA.
7	1.268
8 & 9	1.099
10	3.255
TOTAL	5.622

Scale 1" = 100'

ATTIA LAYOUT.

D. E. ATTIA

ATTIA PRIVATE ROAD. 8' 0"

ROAD WAY

TAN MA SHWE ZIN

DR. DAW HIN MAY

PLOT NO.	AREA IN SQ. FT.	TOTAL AREA
1	17202 SQ. FT.	
2	17082	
3	19642	
4	11500	
5	12580	
6	14150	
7	13350	0.306 acre.
8	13440	
9	13230	
10	11550	
11	12160	
12	13300	
13	17360	
14	11760	
15	18906	
ROAD AREA	35168	
TOTAL AREA	244894	5.622 Acre.

LICENCED ENGINEER  
BO. C. INYA ROAD.  
RANGOON.

ရန် ကုန် မြို့  
စာ ချုပ် စာ တမ်း မှတ် ပုံ တ င် ရုံး တွင်  
မှတ် ပုံ တင် သွင်း သော

“မြေကွက်အပြီးအပိုင် အရောင်းအဝယ် စာချုပ်”

ရက်စွဲ။ ၂၀၁၉ခုနှစ်၊ ဇန်နဝါရီလ ( ၁၁ )ရက်



ပြည်ထောင်စုသမ္မတမြန်မာနိုင်ငံတော်  
REPUBLIC OF THE UNION OF MYANMAR

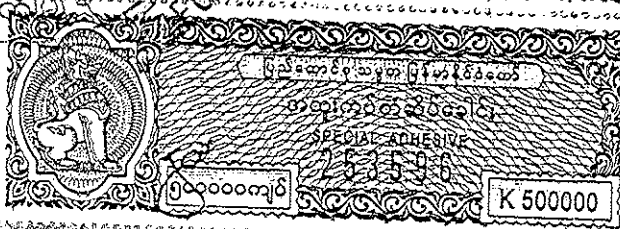
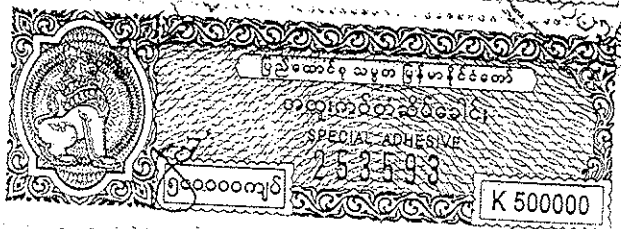
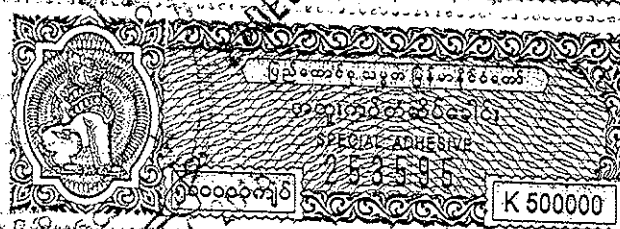
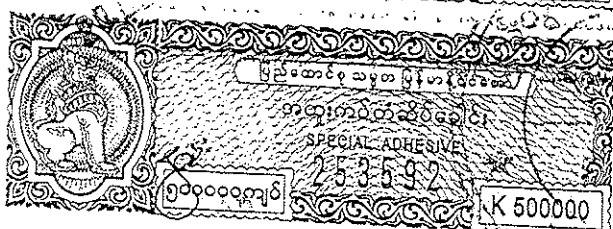
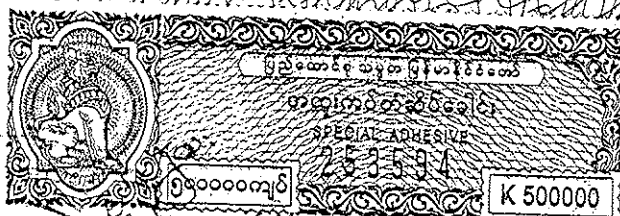
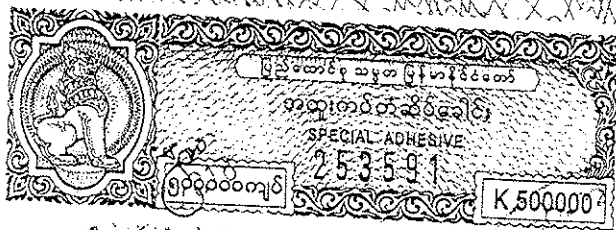
အခွန်တံဆိပ်ခေါင်း  
REVENUE STAMP

၅၀၀၀၀၀ ကျပ်

ဓနဝန်ကြီးဌာန

K 500000

၃၈၀၀၀၀၀



လက်ထပ်ရန်အတွက် တရားရုံးသို့ တင်ပြရန်  
အမတ်ကြီး

“ပြည်ထောင်စုသမ္မတမြန်မာနိုင်ငံတော် အစိုးရအဖွဲ့ အမတ်ကြီး”

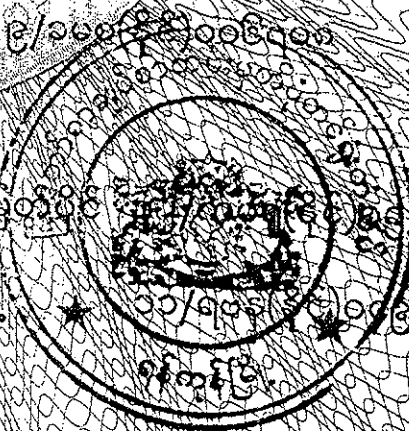
ဦးစီးဌာနချုပ်၊ အထွေထွေအရာရှိ

ရက်စွဲ၊ ၂၀၁၁/၁၁/၁၉

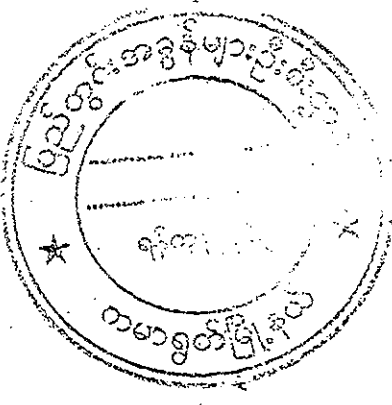
အမတ်ကြီးချုပ် အမတ်ကြီး ဦးတင်ဦး ၉/၁၀၀၀၀၀၀၀၀၀၀၀၀

အမတ်ကြီးချုပ် အမတ်ကြီး ဦးတင်ဦး ၉/၁၀၀၀၀၀၀၀၀၀၀၀၀၀၀

၂၀၁၁/၁၁/၁၉



၂၀၁၁/၁၁/၁၉  
ပြည်ထောင်စုသမ္မတမြန်မာနိုင်ငံတော် အစိုးရအဖွဲ့ အမတ်ကြီး



အမည်	.....
အမျိုးသား	.....
ဧည့်သည်	.....
တံဆိပ်	.....
ဝယ်ယူသူ	.....
စံနှုန်း	.....
ရောင်းချသူ	.....

(ဝင်းမာလာ)  
ဦးစီးဌာန  
ပြည်တွင်းအခွန်ကုန်သွယ်ရေး  
ကဏ္ဍမှူးရုံး

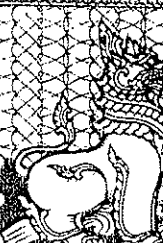
မြန်မာနိုင်ငံ တံဆိပ်ခေါင်း အက်ဥပဒေ ပုဒ်မ  
ဇယား(၁)၏ အမှတ်(၁)အရ (အခွန်).....အရ  
တံဆိပ်ခေါင်းနှင့် ၁၉၀၀၀.၀၀/- ကျပ်မှန်ကန်သည်  
၁၉၂၁ ခုနှစ်၊ ဇန်နဝါရီလ ၁ ရက်နေ့တွင် ပြန်လည်ပင်သာယာရေး  
အက်ဥပဒေ ပုဒ်မ ၉၁(၂)အရ ယပ်မိပေးသော အခွန်  
တော်ငွေ ၁၉၀၀၀.၀၀/- ပုံစံပေါင်း ၁၉၀၀၀.၀၀/-  
စာချုပ်စာတမ်းများမှတ်ပုံတင် ဥပဒေပုဒ်မ  
၁၉၀၀၀.၀၀/- နှင့် ၁၉၀၀၀.၀၀/- နှင့်  
များအရ လက်ခံနိုင်သည်။  
မှတ်ပုံတင်ခရေ - ၁၉၀၀၀၀/-

စာချုပ်စာတမ်းမှတ်ပုံတင်အရာရှိ  
မြို့တော်စာချုပ်ကမ်းမှတ်ပုံတင်ရုံး၊ ရန်ကုန်မြို့၊  
ရက်စွဲ ၁၉၀၀.၀၀.၁၉.....





ပြည်ထောင်စုသမ္မတမြန်မာနိုင်ငံတော်  
REPUBLIC OF THE UNION OF MYANMAR



အခွန်တံဆိပ်ခေါင်း  
REVENUE STAMP

၀၀၀၀၀၀ ကျပ်

ငွေတစ်သိန်းကျပ်

K 100000



“မြေကွက် အပြီးအပိုင် အရောင်းအဝယ်စာချုပ်”

အပိုင်ရောင်းချသူ

ဦးထင်ဦး

၉/၁၂/၈၀ (နှိုင်းစစ်ရက်စွဲ)

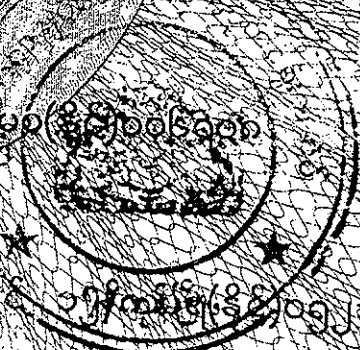
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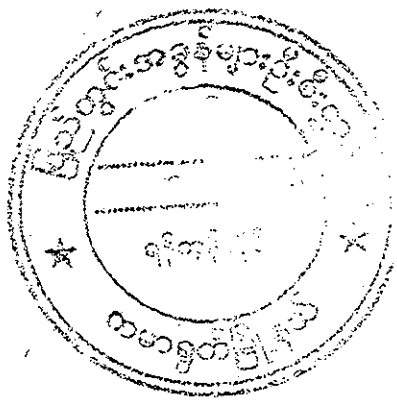
၁။ ဦးတောင်းမြတ်ဝိတ်

၁၂/၁၂/၈၀ (နှိုင်းစစ်ရက်စွဲ)

၂။ ဒေါ်နုနုသန့်

၁၁/၁၂/၈၀ (နှိုင်းစစ်ရက်စွဲ)





ကမ္ဘာ့... ကမ္ဘာ့...  
ကမ္ဘာ့... ကမ္ဘာ့...  
ကမ္ဘာ့... ကမ္ဘာ့...  
ကမ္ဘာ့... ကမ္ဘာ့...  
ကမ္ဘာ့... ကမ္ဘာ့...  
ကမ္ဘာ့... ကမ္ဘာ့...

(ဝင်းအောင်)  
ဦးစီးအရာရှိ  
ပြည်ထောင်စု သစ်တောရေးရာ ဝန်ကြီးဌာန  
ကမ္ဘာ့သစ်တောရေးရာ ဝန်ကြီးဌာန



ပြည်ထောင်စုသမ္မတမြန်မာနိုင်ငံတော်  
REPUBLIC OF THE UNION OF MYANMAR

အခွန်တံဆိပ်စာ  
REVENUE STAMP

ငွေတန်ဆိပ်ကျပ်

K 100000

“မြေကွက် အပြီးအပိုင် အရောင်းအဝယ်စာချုပ်”

အပိုင်ရောင်းချသူ

ဦးတင်ဦး

၉/၁၄

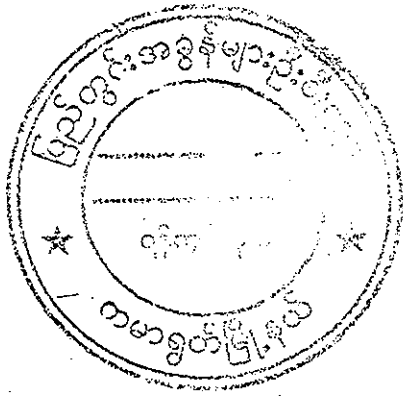
အပိုင်ဝယ်ယူသူများ

၁။ ဦးကောင်းမြတ်ပိုင်

၂။ အောင်မြင်

၂။ ဒေါ်နုနုသန့်

၁၁/၇၀၄(နှိုင်း)၀၄၉၂၇၇



ကမည်	.....ကမည်
ကရီးယား	.....
ရောင်းချသူ	.....
တံဆိပ်	.....
ဝယ်ယူသူ	.....
ဆိုင်ခေါင်းစဉ်	.....
ရောင်းချသည့်နေ့ရက်	.....

*(Handwritten signature)*

(ဝင်းမောင်မောင်)  
ဦးစီးအရာရှိ  
ပြည်ထောင်စုအဖွဲ့အစည်းနှင့် ပညာရေး  
ကမ္ဘာ့အဖွဲ့အစည်း



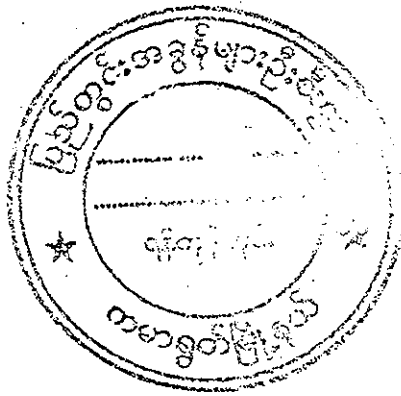
ပြည်ထောင်စုသမ္မတမြန်မာနိုင်ငံတော်  
REPUBLIC OF THE UNION OF MYANMAR

အခွန်တံဆိပ်ခေါင်း  
REVENUE STAMP


ငွေတစ်သိန်းကျပ်

K 100000

“မြေကွက် အပြီးအပိုင် အရောင်းအဝယ်သဘောတူညီချက်”  
အပိုင်ရောင်းချသူ ။ ။ ဦးစွာဦး  
အပိုင်ဝယ်ယူသူများ ။ ။ ၁။ ဦးကောင်းမြတ်ပိုင် ၁၂/ကမရ(နိုင်)၀၅၂၁၁၁  
၂။ ဦးနုသန့် ၁၁/ရမန(နိုင်)၀၄၉၂၇၇



အမည်	.....
အမျိုးသား/မီး	.....
ရောင်းချသူ	.....
တံဆိပ်	.....
ဝယ်ယူသူ၏	.....
အမှတ်စဉ်	.....
ရောင်းချသူ၏	.....

  
 (ဝင်းစုဝင်း)  
 ပြည်ထောင်စုပညာရေးဝန်ကြီး  
 တရားဝင်ရုံးချုပ်



“မြေကွက် အပြီးအပိုင်း အရောင်းအဝယ်စာချုပ်”

၂၀၁၉ခုနှစ်၊ ဇန်နဝါရီလ (၁၁) ရက်နေ့တွင် ရန်ကုန်မြို့စာချုပ်စာတမ်းမှတ်ပုံတင်ရုံး၌ အောက်ပါသူတို့သည် ဤ“မြေကွက်အပြီးအပိုင်အရောင်းအဝယ်စာချုပ်”ကို ပြုလုပ်ချုပ်ဆိုကြသည်မှာ-

အပိုင်ကင်းချသူ      ။      ။      ဦးတင်ဦး(ဘ)    ဦးမောင်ကြည်  
 ၉/၁၆၈(နိုင်)၀၀၆၇၀၈

အမှတ်(၁၀၃)၊ ၅-လွှာ / (၉၁)လမ်း၊

မင်္ဂလာတောင်ညွန့်မြို့နယ်၊ ရန်ကုန်မြို့။

(၄င်းကိုယ်စားရန်ကုန်မြို့စာချုပ်စာတမ်းမှတ်ပုံတင်ရုံး၏(၁-၁၁-၂၀၁၆) )

နေ့စွဲပါအထူးကိုယ်စားလှယ်လွှဲစာအမှတ်( ၉၉၀၃ )အရ ဦးဝေလင်း

(ခ)နီကိုက်ကိန်း ၇/ပခန(ညွှ)၀၀၀၀၈၀ (ဘ) ဦးရန်ထိမ်းမှလက်မှတ်  
ရေးထိုးပါသည်။)

စိုင်းဝယ်ယူသူ           ။           ။

၁။ဦးကောင်းမြတ်ပိုင် (၁၁) နှစ်ခွဲခန့်

၁၂/ကမရ(နိုင်)ဝဠု၁၁၁

၂။ ဒေါ်နုနုသိန်း (ဘ) ဦးစီးသော

၁၁/ရဗန(နိုင)၀၄၉၂၇၇

ခြံအမှတ်(၅၀၇/၇)၊ ပြည်ရိပ်သာလမ်း၊

(၈) ရပ်ကွက်၊ ကမာရွတ်မြို့နယ်၊ ရန်ကုန်မြို့။

(အထက်ပါ အပိုင်ရောင်းချသူ နှင့် အပိုင်ဝယ်ယူသူများဟုဆိုရာတွင် ၎င်းတို့အသီးသီး ကိုယ်တိုင်အပြင်၊ ၎င်းတို့၏ အမွေဆက်ခံခွင့်ရှိသူများ၊ ကိုယ်စားလှယ်များ၊ လွှဲပြောင်းထားသူများပါ အကျုံးဝင် ဝင်ပတ်သက်ပြီး ဖြစ်သည်ဟု မှတ်ယူရမည်။)

အောက်ပါပစ္စည်း စာရင်းတွင် အသေးစိတ်တိကျစွာ ဖော်ပြထားသော မြေကွက်နှင့် ယင်းမြေကွက်ပေါ်ရှိ အိမ်အပါအဝင်အကျိုးခံစားခွင့် အရပ်ရပ်အားလုံးတို့သည် ရန်ကုန်မြို့တော် စည်ပင်သာယာရေး ကော်မတီ ပြုစီမံကိန်းနှင့်မြေစီမံခန့်ခွဲမှုဌာနရှိ မှတ်တမ်းထိန်းသိမ်းဌာနမြို့မြေစာရင်းတွင် ရောင်းချသူ ဦးတင်ဦး

...ရန်ကုန်...မြို့ရှိ ရန်ကုန်မြို့တော်စာချုပ်စာတမ်း  
မှတ်ပုံတင်ရုံး၌ ...လ...ရက်နေ့ နံနက်/မွန်းလွဲ.....နာရီအချိန်တွင်  
...မြို့နယ်...ရပ်ကွက်နေ  
အဘ ဦး...၏သား/သမီး ဦး...၏အမည်  
ကစာချုပ်စာတမ်းမှတ်ပုံတင်ရန် တင်သွင်းသည်။

စာချုပ်စာတမ်းမှတ်ပုံတင်အရာရှိ  
မြို့တော်စာချုပ်စာတမ်းမှတ်ပုံတင်ရုံး၊ ရန်ကုန်မြို့  
ရက်စွဲ၊ ...

ဦး...  
၁၂/ကမာရ (၁၆၄) ၀၅၂၁၁၁



၂.၁၆၂၀

...ရန်ကုန်...မြို့ရှိ ရန်ကုန်မြို့တော်စာချုပ်စာတမ်း  
မှတ်ပုံတင်ရုံး၌ ...လ...ရက်နေ့ နံနက်/မွန်းလွဲ.....နာရီအချိန်တွင်  
...မြို့နယ်...ရပ်ကွက်နေ  
အဘ ဦး...၏သား/သမီး ဦး...၏အမည်  
တို့က ချုပ်ဆိုကြောင်း ပြောဆိုသည်။

ဦး...  
၁၂/ကမာရ (၁၆၄) ၀၅၂၁၁၁



၂.၁၆၂၀

...ရန်ကုန်...မြို့ရှိ ရန်ကုန်မြို့တော်စာချုပ်စာတမ်း  
မှတ်ပုံတင်ရုံး၌ ...လ...ရက်နေ့ နံနက်/မွန်းလွဲ.....နာရီအချိန်တွင်  
...မြို့နယ်...ရပ်ကွက်နေ  
အဘ ဦး...၏သား/သမီး ဦး...၏အမည်  
တို့က ချုပ်ဆိုကြောင်း ပြောဆိုသည်။

ဦး...  
၁၁/၇၀၇ (၁၆၄) ၀၅၉၂၇၇



၂.၁၆၂၁



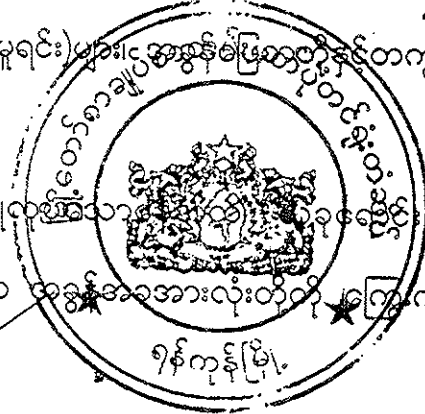
မည်ဖြင့်တည်ရှိသော မြေပိုင်မြေကွက် ဖြစ်ပါသည်။

အပိုင်ရောင်းချသူက မိမိသာလျှင် တရားဝင်ပိုင်ဆိုင်ပြီး၊ လွှဲပြောင်းရောင်းချပိုင်ခွင့်ရှိသောအောက်  
ရင်းပါ မြေကွက်နှင့်မြေကွက်ပေါ်ရှိ အကျိုးခံစားခွင့်အရပ်ရပ်တို့အား အပိုင်ဝယ်ယူသူများထံသို့ တန်ဘိုးငွေ  
၅၀,၀၀၀/- (ကျပ်သိန်းကိုးရာဇးဆယ်တိတိ) ဖြင့် ရောင်းချရန် စကားကမ်းလှမ်းပါသည်။

အပိုင်ဝယ်ယူသူများကလည်း ယင်းတန်ဘိုးဖြင့်ပင် အပိုင်ဝယ်ယူရန် သဘောတူညီသဖြင့် ရောင်းဘိုးငွေ  
၅၀,၀၀၀,၀၀၀/- (ကျပ်သိန်းကိုးရာဇးဆယ်တိတိ)ကို ပေးချေရာ အပိုင်ရောင်းချသူက ငွေကြေးဖြင့်  
တစ်လုံးတစ်ခဲတည်း အပြည့်အဝ လက်ခံရရှိကြောင်း ဝန်ခံကတိပြုပါသည်။

အပိုင်ဝယ်ယူသူများကလည်း ရောင်းချသော မြေကွက်နှင့်မြေပေါ်ရှိ အကျိုးခံစားခွင့်အရပ်ရပ်တို့အား  
ဆိုင်မှုစာချုပ်စာတမ်း(မူရင်း)များ၊ ဆက်စပ်စာချုပ်(မူရင်း)များ၊ အခွန်မပြုတတ်နိုင်သဖြင့် လက်ခံရရှိကြောင်း  
ဝန်ခံကတိပြုပါသည်။

အပိုင်ရောင်းချသူသည် အရောင်းအဝယ်ပြုလုပ်သောအခါ အခွန်အခကြေးငွေများ ပစ္စည်းနှင့်  
ပတ်သက်သည့် နိုင်ငံတော်သို့ ထမ်းဆောင်ရန်ရှိသော အခွန်အခအားလုံးတို့ကို ကျန်မရှိ ထမ်းဆောင်  
ပြီးဖြစ်ကြောင်းကိုလည်း ဝန်ခံကတိပြုပါသည်။



အပိုင်ရောင်းချသူက ရောင်းချသောပစ္စည်းနှင့်ပတ်သက်၍ ထုတ်ဖော်ဝန်ခံသည်မှာ အဆိုပါပစ္စည်း သည်  
သာလျှင်တရားဝင်ပိုင်ဆိုင်ကြောင်း၊ အမွေစားအမွေခံအရှုပ်အရှင်းကင်းရှင်းကြောင်း၊ အခြားသူတစ်ပါး  
အပိုင်ရောင်းချထားခြင်း၊ ပေါင်နှံထားခြင်း၊ ပေးကမ်းထားခြင်း၊ စွန့်လွှတ်လှူဒါန်းထားခြင်း၊ အာမခံပစ္စည်း  
ဖြစ်တင်သွင်းထားခြင်း မရှိကြောင်း၊ အရှုပ်အရှင်းတစ်စုံတစ်ရာပေါ်ပေါက်လာပါက အပိုင်ရောင်းချသူမှ မိမိ  
တို့ဖြင့် ပြေလည်သည့် တိုင်အောင် ဖြေရှင်းပေးရန်နှင့် ယင်းသို့ ဖြေရှင်းပေးသည့်တိုင် မပြီးပြတ်ဘဲ အပိုင်  
ဝယ်ယူသူများတွင် ပစ္စည်းသော်လည်းကောင်း၊ ငွေသော်လည်းကောင်း၊ လက်လွှတ်ဆုံးရှုံးနှစ်နာရပါက အရောင်း  
အဝယ်ပြုလုပ်သည့်ပစ္စည်း၏ ကာလပေါက်ဈေး တန်ဘိုးငွေများနှင့်တကွ နှစ်နာမူအရပ်ရပ်အားလုံးတို့ကို  
ငွေကြေးဖြင့် တစ်လုံးတစ်ခဲတည်း အမြန်ဆုံး ပြန်လည်ပေးလျှော်ပါမည်ဟု ဝန်ခံကတိပြုပါသည်။

မိမိကတော့... မြို့... (၁၂) ရပ်ကွက်နေ  
 အဘ ဦး... / သမီး... (၁)  
 ...  
 စာချုပ်စာတမ်းမှတ်ပုံတင်အရာရှိ  
 သက်သေခံလက်မှတ်ရေးထိုးထားသည့်...  
 ကိုယ်စားလှယ်လွှဲ စာချုပ်အမှတ်... အရ  
 ...  
 ... အတွက်ကိုယ်စားလှယ်ပြုလုပ်ရန်  
 ချုပ်ဆိုကြောင်း ပြောဆိုသည်။



V.၁၆၂၂

စာချုပ်

ဦးဝေလင်း (၁) နိမိတ်လက်  
 ပုံ.ပခ ၄(၁၅) ၀၀၀၀၈၀.

စာချုပ်စာတမ်းမှတ်ပုံတင်အရာရှိ  
 မြို့တော်စာချုပ်စာတမ်းမှတ်ပုံတင်ရုံး၊ ရန်ကုန်မြို့၊ ဦးတင်ဦး ကိုယ်စား SP. ၉၉၀၃ / ၂၀၁၆  
 ရက်စွဲ၊ ၂၀၁၆.၁၁.၁၆  
 ဖက်ဗြတ် စာထိုးသည် " )

ကမ္ဘာ့... မြို့... (၁၂) ရပ်ကွက်နေ  
 အဘ ဦး... / သမီး...  
 ...  
 စာချုပ်စာတမ်းမှတ်ပုံတင်အရာရှိ  
 သက်သေခံလက်မှတ်ရေးထိုးထားသည့်...  
 ကိုယ်စားလှယ်လွှဲ စာချုပ်အမှတ်... အရ  
 ...  
 ... အတွက်ကိုယ်စားလှယ်ပြုလုပ်ရန်  
 ချုပ်ဆိုကြောင်း ပြောဆိုသည်။



V.၁၆၂၃

စာချုပ်

ဒေါ်မေရအုန်း ဦး  
 ၁၄၊ ၁၆၂၇ (၁၆) ၀၆၃၉၂၅

ချုပ်ဆိုသူ၏ကိုယ်စားလှယ်ဦး/ဒေါ်...  
 ကစာချုပ်တွင်ပါရှိသည့်အဖိုးစားကိုလက်ခံရ  
 ရှိကြောင်းပြောဆိုသည်။

စာချုပ်စာတမ်းမှတ်ပုံတင်အရာရှိ  
 မြို့တော်စာချုပ်စာတမ်းမှတ်ပုံတင်ရုံး၊ ရန်ကုန်မြို့၊  
 ရက်စွဲ၊ ၂၀၁၆.၁၁.၁၆



အရောင်းအဝယ်ပြုလုပ်သည့်ပစ္စည်းစာရင်း

ရန်ကုန်တိုင်းဒေသကြီး၊ ကမာရွတ်မြို့နယ်၊ မြေတိုင်းရပ်ကွက်အမှတ် -  
(၃၆-E)၊ အောင်မင်းခေါင်စေတီလမ်း၊ မြေကွက်အမှတ် - (၁၀၂၆/၃၉) ဟုခေါ်  
တွင်သည့် (၀.၀၂၉) ဧကအကျယ်ရှိ မြေပိုင်ဆိုင်မှုနှင့် မြေကွက်ပေါ်ရှိ  
အကျိုးခံစားခွင့်အရပ်ရပ်အားလုံး



အထက်အမည်ပါ အပိုင်ရောင်းချသူနှင့် အပိုင်ဝယ်ယူသူများသည် စကားရပ်များကို  
သေချာစွာ ဖတ်ရှုသိရှိနားလည်သဘောပေါက်ကြပြီးဖြစ်၍ အပိုင်ဝယ်ယူမှု၏ တိုက်တွန်းခြင်း၊  
စေခိုင်းခြင်း၊ အတင်းအကြပ်ပြုခြင်း၊ ခြိမ်းခြောက်ခြင်း၊ အနိုင်အထက်ပြုခြင်းတို့ မပါရှိဘဲ မိမိတို့၏ လွတ်လပ်  
သောသဘောဆန္ဒအရ အောက်ပါအသိသက်သေများရှေ့တွင် လက်မှတ်ရေးထိုးကာ ဤ“မြေကွက်  
အပြီးအပိုင်အရောင်းအဝယ်စာချုပ်”ကို ပြုလုပ်ချုပ်ဆိုကြခြင်းဖြစ်ပါသည်။

အသိသက်သေများ

အပိုင်ရောင်းချသူ

*[Signature]*

*[Signature]*

၁။ ဒေါ်မေရည်စိုးဦး(ဘ)ဦးအောင်စိုးဦး

ဦးတင်ဦး

၁၄/၀၈န(နိုင်)၀၆၃၉၂၅

၉/၁၁၀(နိုင်)၀၀၆၇၀၈

အမှတ်(၅၀၅/၆၁)၊ ပြည်ရိပ်သာလမ်း၊

(၄င်းကိုယ်စား ရန်ကုန်မြို့စာချုပ်စာတမ်းမှတ်ပုံတင်ရုံး၏(၁-၁၁-၂၀၁၆)

(၈)ရပ်ကွက်၊ ကမာရွတ်မြို့နယ်။

နေ့စွဲပါအထူးကိုယ်စားလှယ်လွှဲစာ VI - ၉၉၀၃ အရဦးဝေလင်း(ခ)နီကိုက်ကိန်း

(ဘ)ဦးရန်အိဝါး ၇/၀၈န(ဧည့်)၈၀၀၀၈၀ မှလက်မှတ်ရေးထိုးပါသည်။)

*[Signature]*

အပိုင်ဝယ်ယူသူများ

၂။ ဒေါက်တာသန်းထွဋ်အောင်(ဘ)ဦးဌေးအောင်

၁၂/လမန(နိုင်)၀၀၀၄၁၅

ခြံအမှတ်(၅၀၅/၆၁)၊ ပြည်ရိပ်သာလမ်း၊

၁။ ဦးကောသလမြတ်ပိုင် ၁၂/ကမရ(နိုင်)၀၅၂၁၁၁

(၈)ရပ်ကွက်၊ ကမာရွတ်မြို့နယ်။

၂။ ဒေါ်နုနုသန့် ၁၁/ရမန(နိုင်)၀၄၉၂၇၇







ပြည်ထောင်စုသမ္မတမြန်မာနိုင်ငံတော်  
ရန်ကုန်မြို့တော်စည်ပင်သာယာရေးကော်မတီ

၁၅

ကမရ / ပုံ - ၂၀၁၈၀၁၇၇၄၅ (၇-၁၁-၁၈)

၂၀၁၈/၂၀၁၉ ဘဏ္ဍာရေးနှစ်သုံး မြေပုံမှရေးကူးပေးသည့်  
မှန်ကန်ကြောင်းသက်သေခံသည့်မိတ္တူမြေပုံ

အမည်ပေါက် ဦးတင်ဦး  
၉/မမစ(နိုင်)၀၀၆၇၀၈

မြေတိုင်းရပ်ကွက်အမှတ် ၁၆-၉  
စာချုပ်စာတမ်းမှတ်ပုံတင်အရာရှိ

လူနေရပ်ကွက်အမှတ်မြို့တော်စာချုပ်စာတမ်းမှတ်ပုံတင်ရန်ကုန်မြို့  
ရက်စွဲ ၁၇.၁၁.၂၀၁၉

မြေကွက်အမှတ် ၁၀၂၆/၃၉

မြေအမျိုးအစား မြေပိုင်မြေ  
မစိုက်ပျိုးမြေ

မြေအတွင်းအတာ (အလျဉ်းအမတ်)  
၀.၀၂၉ ဧက

ကမာရွတ်မြို့နယ်

၁:၁၂၀၀

ရန်ကုန်မြို့တော်စည်ပင်သာယာရေးကော်မတီ

အရောင်းအဝယ်စာချုပ်ချုပ်ဆိုရန်

၁၅.၁၁.၁၈

မြို့နယ်တာဝန်ခံ (ကွန်ပျူတာ)  
မြို့ပြစီမံကိန်းနှင့် ဖြေဆိုခံရသူ

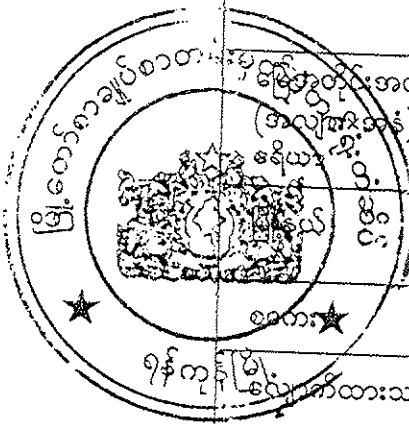
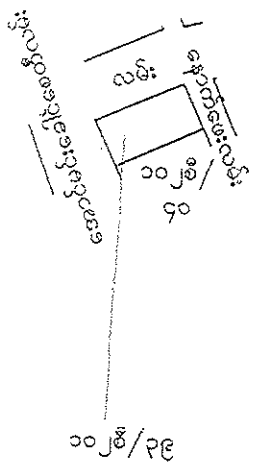
၁၅.၁၁.၁၈

မြေတိုင်း (၂)  
မြို့ပြစီမံကိန်းနှင့် ဖြေဆိုခံရသူ

၁၆.၁၁.၂၀၁၈

မြို့နယ်တာဝန်ခံ (ကွန်ပျူတာ)  
မြို့ပြစီမံကိန်းနှင့် ဖြေဆိုခံရသူ

ရည်ရွယ်ချက်စွဲ ၁၆.၁၂.၁၈



၁၇.၁၁.၁၈

မြို့နယ် (ကိုယ်စား)



ဘဏ္ဍာရေးနှစ်သုံး မြေပုံ/မြို့မြေစာရင်းမှ ရေးကူး  
မှတ်ချက် မိတ္တူမြေပုံ/မြေရာဝေငံဖြစ်၍  
ကြောင်းထောက်ခံပါသည်  
(မြို့ပြစီမံကိန်း နှင့် မြေပိုင်ခန့်ခွဲမှုဌာန)

ရန်ကုန်မြို့ဒုတိယတန်းသင်တန်းရေးကော်မတီ

မြို့ပြစီမံကိန်းနှင့်မြေစီမံခန့်ခွဲမှုဌာန

JCODE = 5126

V2P39 LCODE = 030500010401

မြေတိုင်းရပ်ကွက် 36-E  
မြို့နယ် ကမာရွတ်မြို့နယ်

လျှောက်ထားသည့် အကြောင်းအရာ - အရောင်းအဝယ်စာချုပ်ချုပ်ဆိုရန်

က - ကနဦးမှတ်သားချက်များ				ခ - ပြောင်းလွှဲခြင်းအတွက် ပြောင်းလွှဲရာတွင် ပါဝင်သည့်မြေကွက်ငယ်များ			
အမှတ်	ဧရိယာ	ဂရန်(သို့)မြေငှား(သို့)လိုင်စင် (သို့)အငှားချထားခံရသူ၏ အမည်နှင့်နေရပ်	လေး "၃" တွင် ဖော်ပြသူ၏ ပိုင်ဆိုင်ခွင့် အမျိုးအစား	မြေခွန်/မြေခ	မှတ်ပုံတင်စာချုပ် အမှတ်နှင့်နေ့စွဲ	လွှဲပြောင်းခံရသူ၏ အမည်နှင့်နေ့စွဲ	လွှဲပြောင်းမှုအမျိုးအစား
(၂)	(၃)	(၄)	(၅)	(၆)	(၇)	(၈)	
၃၉	၀.၀၂၉ ဧက	x x x	မြေပိုင်မြေ မစိုက်ပျိုးမြေ	၁၄၀၃/၂၀၀၀(၃. ၇. ၂၀၀၀) အရောင်း	ဦးတင်ဦး ၉/မေ(၂၀၀၆)၀၀၆၇၀၈	အမှုတွဲအမှတ်-ကမရ/ပြောင်း- ၄၅/၂၀၀၁(၁၆. ၅. ၂၀၀၁)အရပြောင်း	
<div>၁၈/၂၀၁၉ ကဏ္ဍရေးနှင့်သုံး မြေပုံ/မြို့မြေစာရင်းမှ ရေးကူး စကောက်နှုတ်ချက် မိတ္တူမြေပုံ/မြေရာထောင်ဖြစ်၍ ချမှန်တန်ကြောင်းထောက်ခံပါသည်</div>				<div>အမှတ်-၃၉၊အောင်မင်းခေါင်ဘုရားလမ်း၊ကမာရွတ်မြို့နယ်။</div>			

စည်ရက်စွဲ၊ ၂၆.၁၂.၁၈

၂၆.၁၂.၂၀၁၈  
ဌာနမှူး(ကွန်ပျူတာ)  
မြို့ပြစီမံကိန်းနှင့်မြေစီမံခန့်ခွဲမှုဌာန

၂၀.၁၂.၂၀၁၈  
မြေတိုင်း(၂)  
မြို့ပြစီမံကိန်းနှင့်မြေစီမံခန့်ခွဲမှုဌာန

၁၅.၁၂.၁၈  
မြို့နယ်တာဝန်ခံ(ကွန်ပျူတာ)  
မြို့ပြစီမံကိန်းနှင့်မြေစီမံခန့်ခွဲမှုဌာန



# ရန်ကုန်မြို့

စာချုပ်စာတမ်းများမှတ်ပုံတင်ရုံး၌  
မှတ်ပုံတင်သွင်းချုပ်ဆိုသော

## မြေနှင့် နေအိမ် အပြီးအပိုင်အရောင်းအဝယ်စာချုပ်

အပိုင်ရောင်းသူ ။ ။ အိမ်သားသားရီ (သ) ဦးလှမောင်  
၁၂/ကမရ (နိုင်) ၀၀၇၄၃၁

အပိုင်ဝယ်သူများ ။ ၁။ ဦးခိုင်ဝင်း (သ) ဦးစိန်ဌေး  
၁၂/မရက (နိုင်) ၀၀၀၁၇၂  
၂။ အိမ်စောလွင် (သ) ဦးမြင့်လွင်  
၆/မအရ (နိုင်) ၀၀၀၈၈၂

ရန်ကုန်မြို့။

နေ့စွဲ၊ ၂၀၁၃-ခုနှစ် ၊ စက်တင်ဘာလ(၂၀)ရက်။

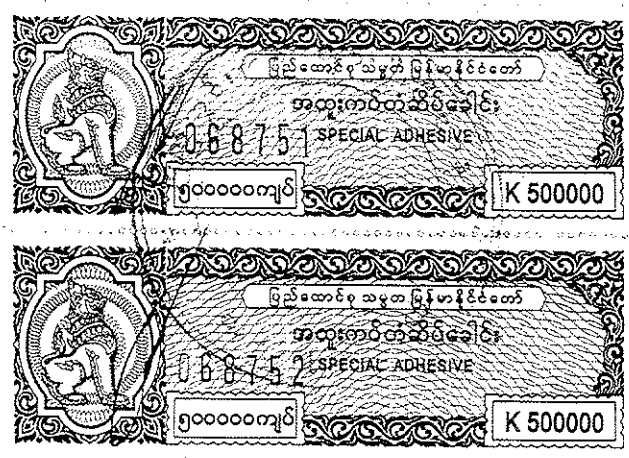
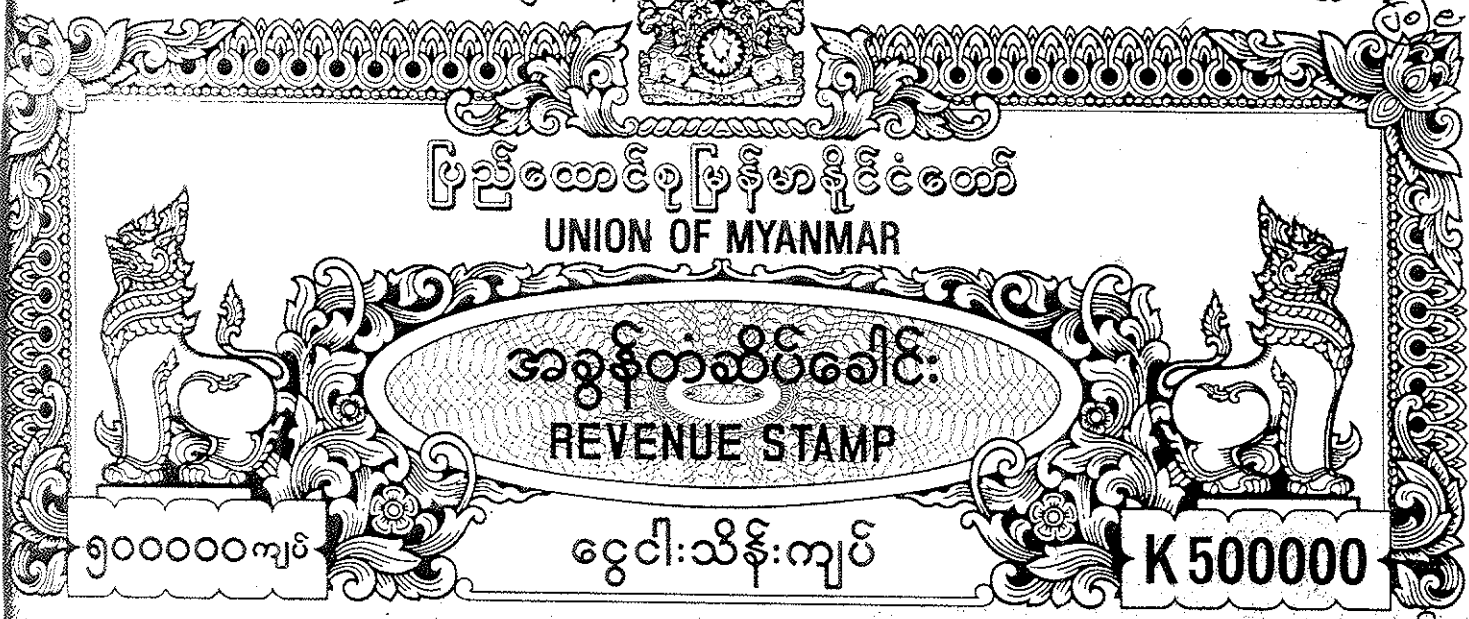
၃၇၂၀

၁၄၈၅၁၃

၁၂၄၀၄၁

၁၈၂၁၁၁

၁၈၂၁၁၁



( ၁ )

မြေနှင့် နေအိမ် အပြီးအပိုင်အရောင်းအဝယ်စာချုပ်

အပိုင်ရောင်းသူ ။

၁။ အိသင်းသင်းရီ (ဘ) ဦးလှမောင်  
၁၂/ကမရ (နိုင်) ၀၀၇၄၃၁

အပိုင်ဝယ်သူများ ။

၁။ ဦးခိုင်ဝင်း (ဘ) ဦးစိန်ဌေး  
၁၂/မရက (နိုင်) ၀၀၀၁၂၂  
၂။ အိစွာလွင် (ဘ) ဦးမြင့်လွင်  
၆/မအရ (နိုင်) ၀၀၀၈၈၂



၁၇.၁၁.၁၃

၇၇၇၇ နီ.နီ.မေ.ရ. ၁၅၁၃/၁၁၂

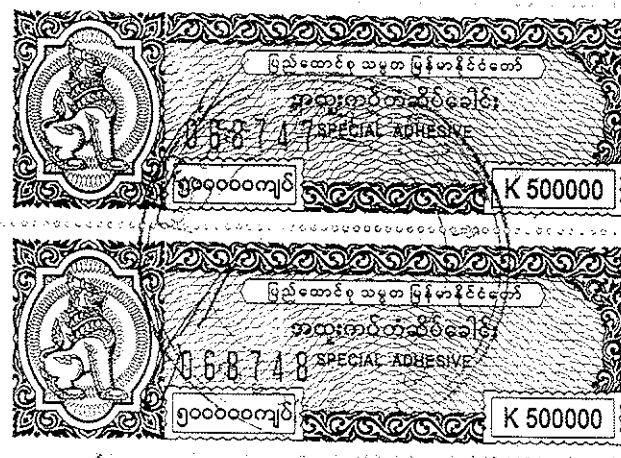
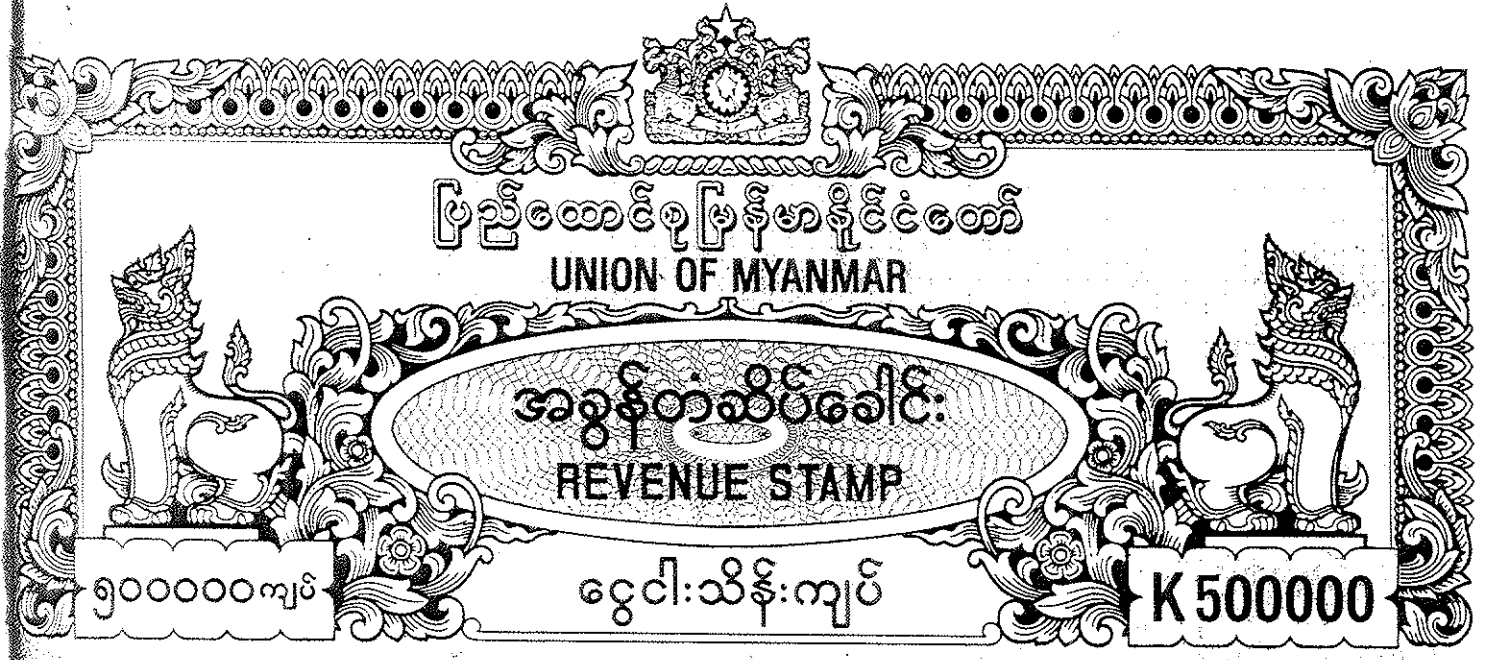
(၁၀၁၁)



စာမျက်နှာ	၁၁	ရက်စွဲ	၁၂/မတ်(၁၉) ၁၉၈၁
အမှတ်	၁၉-၉-၂၀၁၃		
ရက်စွဲ	ကျွန်ုပ်တို့၏ သိပ်သည်းစွာ		
ရက်စွဲ	ရက်စွဲ		

ထပ်ဆင့်ရေးမှတ်ချက်များကို စာမျက်နှာ ၁၁၆, ၁၈, ၁၉ တွင်ကြည့်ပါ။

စာချုပ်စာတမ်းမှတ်ပုံတင်ဌာနမှ  
နေ့စွဲ ၁၀.၉.၁၃ စာချုပ်စာတမ်းမှတ်ပုံတင်ခံ  
ရန်ကုန်မြို့။



(၂)

မြေနှင့် နေအိမ် အပြီးအပိုင်အရောင်းအဝယ်စာချုပ်

အပိုင်ရောင်းသူ ။ ။ ဧိသင်းသင်းရီ (ဘ) ဦးလှမောင်  
၁၂/ကမရ (နိင်) ၀၀၇၄၃၁

အပိုင်ဝယ်သူများ ။ ၁။ ဦးခိုင်ဝင်း (ဘ) ဦးစိန်ဌေး  
၁၂/မရက (နိင်) ၀၀၀၁၇၂  
၂။ ဧိစန္ဒာလွင် (ဘ) ဦးမြင့်လွင်  
၆/မအရ (နိင်) ၀၀၀၈၁၂





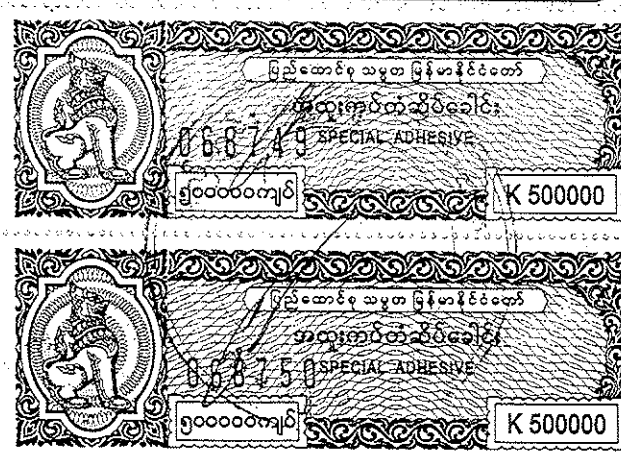
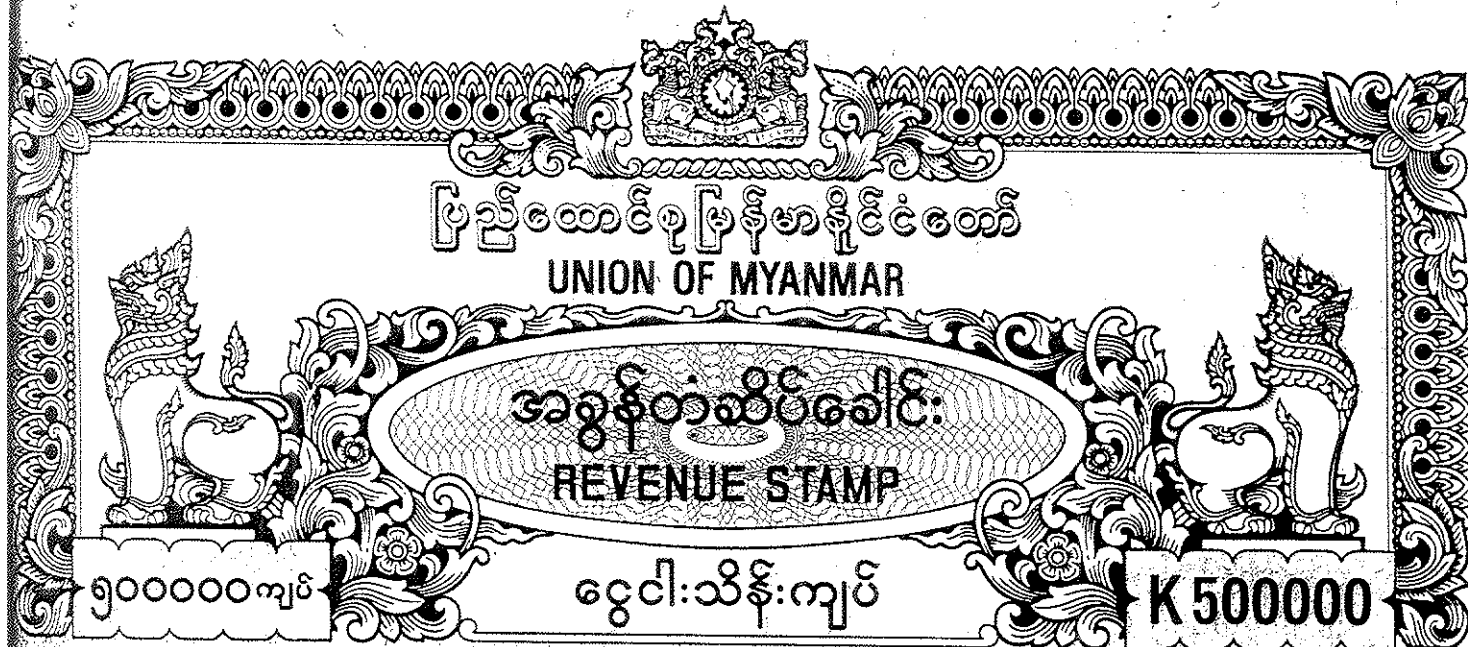
အမည်	ဦး သိန်းလင်း
အမှတ်	၁၂/မဟာမုနိ(၁၀၀၀)လမ်း
အရပ်	၁၉၀၉၊ ၂၀၁၃
အခြား	
တပ်	လှိုင်တပ်မတော်
ရောင်းချသူ	

မြန်မာနိုင်ငံတော်တံဆိပ်ခွန် အက်ဥပဒေပုဒ်မ(၃)၊ ဇယား  
 (၁)၏ အမှတ်စဉ် ..... အရ၊ အခွန်တော်  
 ကျပ် ..... မြန်မာနိုင်ငံတော်  
 စာချုပ်စာတမ်းမှတ်ပုံတင် အက်ဥပဒေပုဒ်မ(.....)  
 .....  
 များအရ လက်ခံနိုင်သည်။  
 မှတ်ပုံတင်ခရေဒ -

စာချုပ်စာတမ်းမှတ်ပုံတင်ဌာနမှူး  
 နေ့စွဲ .. ..... စာချုပ်စာတမ်းမှတ်ပုံတင်ရုံး  
 ရန်ကုန်မြို့။

မြန်မာနိုင်ငံ တံဆိပ်ခွဲခေါင်း အက်ဥပဒေ ပုဒ်မ(၃)  
 ဇယား(၁)၏ အမှတ်စဉ်(အပိုဒ်).....၁၃.....အရ  
 တံဆိပ်တော်ခွန် ၆၄၅၅၅၀၀၀၀၀ ကျပ်တန်သည်။  
 ၁၉၂၀ ခုနှစ်၊ ရန်ကုန်မြို့တော်စည်ပင်သာယာရေး  
 အက်ဥပဒေပုဒ်မ ၉၀(၂)အရ ထပ်မံပေးသော အခွန်  
 တော်ငွေ ၆၅၅၅၀၀၀၀၀ ကျပ်ကို ၆၄၅၅၀၀၀၀၀  
 မြန်မာနိုင်ငံတော် စာချုပ်စာတမ်းမှတ်ပုံတင် အက်  
 ဥပဒေပုဒ်မ ၁၇၊ ၁၈၊ ၁၉၊ ၂၀၊ ၂၁၊ ၂၂၊ ၂၃၊ ၂၄  
 များအရ လက်ခံနိုင်သည်။  
 မှတ်ပုံတင်ခရေဒ - ၁၈၂၁၁၀၀၀

စာချုပ်စာတမ်းမှတ်ပုံတင်ဌာနမှူး  
 နေ့စွဲ ၂၀၁၃.၀၉.၁၇ စာချုပ်စာတမ်းမှတ်ပုံတင်ရုံး  
 ရန်ကုန်မြို့။



( ၃ )

မြေနှင့် နေအိမ် အပြီးအပိုင်အရောင်းအဝယ်စာချုပ်

အပိုင်ရောင်းသူ ။ ။ ဧိသင်းသင်းရီ (တ) ဦးလှမောင်  
၁၂/ကမရ (နိင်) ၀၀၇၄၃၁

အပိုင်ဝယ်သူများ ။ ။ ၁။ ဦးခိုင်ဝင်း (တ) ဦးစိန်ဌေး  
၁၂/မရက (နိင်) ၀၀၀၁၇၂  
၂။ ဧိစန္ဒာလွင် (တ) ဦးမြင့်လွင်  
၆/မအရ (နိင်) ၀၀၀၈၈၂





*[Handwritten signature]*

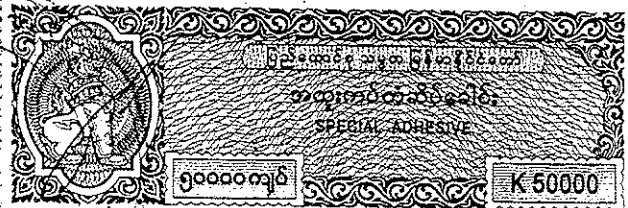
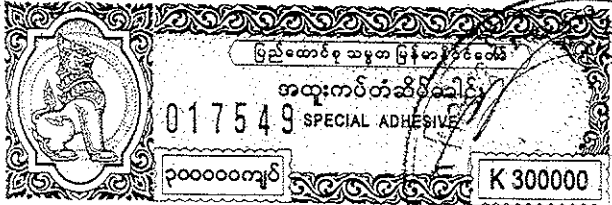
ပြည်ထောင်စု ဖြန့်ဖြူးခြင်း  
UNION OF MYANMAR

အခွန်ကောက်ခံခြင်း  
REVENUE STAMP

၅၀၀၀၀၀ကျပ်

ငွေငါးသိန်းကျပ်

K 500000



( ၄ )

မြေနှင့် နေအိမ် အပြီးအပိုင်အရောင်းအဝယ်စာချုပ်

အပိုင်ရောင်းသူ ။

၁။ ဇော်သင်းသင်းရီ (ဘ) ဦးလှမောင်

၁၂/ကမရ (နိုင်) ၀၀၇၄၃၁

အပိုင်ဝယ်သူများ ။

၁။ ဦးခိုင်ဝင်း (ဘ) ဦးစိန်ဌေး

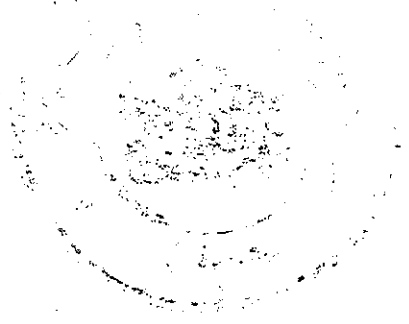
၁၂/မရက (နိုင်) ၀၀၀၁၂၂

၂။ ဇော်စန္ဒာလွင် (ဘ) ဦးမြင့်လွင်

၆/မအရ (နိုင်) ၀၀၀၈၈၂



အမည်	ဦး ခိုင်လုံ	အဘအမည်	ဦး သိန်းဌေး
အမျိုးအမည်	ကျေးလက်	အသက်	၁၂
နေထိုင်ရာ	မင်းဇေယျဝံ	ရက်စွဲ	၁၉၆၀
အခြား			
အမှတ်	ကျေးရွာသစ်	ရက်စွဲ	၁၉၆၀
ရောင်းချသူ	ဦး သိန်းဌေး		







20

*[Handwritten notes:]*

- 10000/mwh/c
- cost base.

സ്റ്റാഫ്: ഓഫീ: അടയാളം

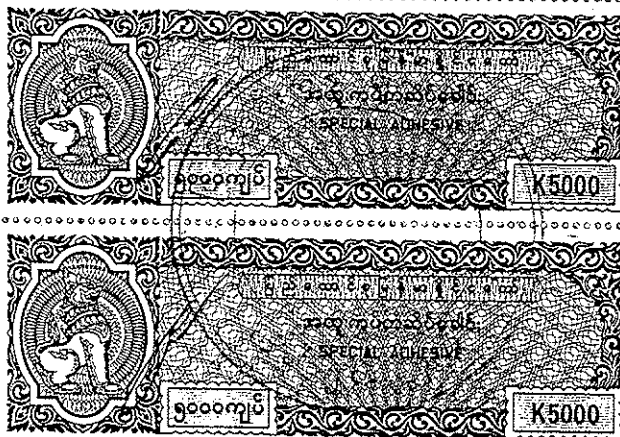
ပြည်ထောင်စု ဖြန့်ဖြူးနိုင်ငံတော်  
UNION OF MYANMAR

အခွန်တံဆိပ်ခေါင်း  
REVENUE STAMP

၅၀၀၀၀၀ ကျပ်

ငွေငါးသိန်းကျပ်

K 500000



( ၆ )

မြေနှင့် နေအိမ် အပြီးအပိုင်အရောင်းအဝယ်စာချုပ်

အပိုင်ရောင်းသူ ။

၁။ အိမ်သားသားရီ (သ) ဦးလှဟောင်

၁၂/ကလေး (နိင်) ၀၀၇၇၃၁

အပိုင်ဝယ်သူများ ။

၁။ ဦးခိုင်ဝင်း (သ) ဦးစိန်ဌေး

၁၂/မရက (နိင်) ၀၀၀၁၇၂

၂။ အိမ်နွားလွင် (သ) ဦးမြင့်လွင်

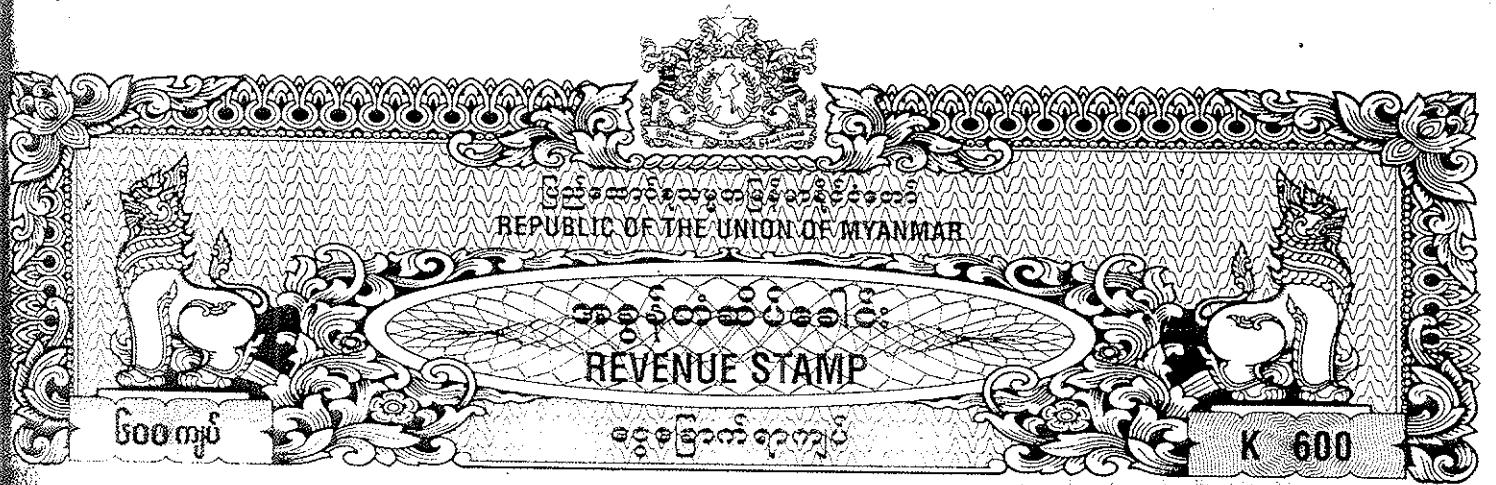
၆/မအရ (နိင်) ၀၀၀၈၈၂





၁၀၂၆

အမည်	မြသီလဝင်း	အဘယအမည်	မြသီလဝင်း
အသက်	၁၂	အမျိုးသား	မ
အလုပ်	ကျောင်းသား	အခြားအချက်	
အိမ်လမ်း	ကျောင်းသားအိမ်လမ်း		



( ၇ )  
မြေနှင့် နေအိမ် အပြီးအပိုင်အရောင်းအဝယ်စာချုပ်

၂၀၁၃-ခုနှစ်၊ စက်တင်ဘာလ (၂၀) ရက်နေ့တွင် ရန်ကုန်မြို့စာချုပ်စာတမ်းမှတ်ပုံတင်ရုံး၌ အောက်အမည်ပါသူ တို့သည် ဤ "မြေ နှင့် နေအိမ် အပြီးအပိုင် အရောင်းအဝယ်စာချုပ်" ကို ပြုလုပ်ချုပ်ဆိုကြသည်မှာ -

အပိုင်ရောင်းသူ ။ ။ အိမ်သုံးသုံးရံ (ဘ) ဦးလှမောင်  
၁၂/ကမရ (နိုင်) ၀၀၇၄၃၁  
အမှတ် - ၄၀၊ အောင်မင်းခေါင်တုရားလမ်း၊ (၁၀) ရပ်ကွက်၊  
ကမာရွတ်မြို့နယ်၊ ရန်ကုန်တိုင်းဒေသကြီး ။  
(၎င်း၏ကိုယ်စား ရန်ကုန်မြို့စာချုပ်စာတမ်းမှတ်ပုံတင်ရုံး၏ အထူးကိုယ်စားလှယ်  
လွှဲစာအမှတ် (၁၁၈၇၈/၂၀၁၃) အရ အိမ်နီးယုမော် (၁၂/ရကန (နိုင်) ၀၂၂၃၁၇) မှ  
လက်မှတ်ရေးထိုးချုပ်ဆိုပါသည်။)

အပိုင်ဝယ်သူများ ။ ။ ဦးခိုင်ဝင်း (ဘ) ဦးစိန်ဌေး  
၁၂/မရက (နိုင်) ၀၀၀၁၂၂  
၂။ အိမ်နွာလွင် (ဘ) ဦးမြင့်လွင်  
၆/မအရ (နိုင်) ၀၀၀၈၈၂  
အခန်း (၁၀၆) ၊ တိုက် (အက်မ်) ၊ ပါရမီကွန်ဒို၊ လှိုင်မြို့နယ်၊ ရန်ကုန်တိုင်းဒေသကြီး ။

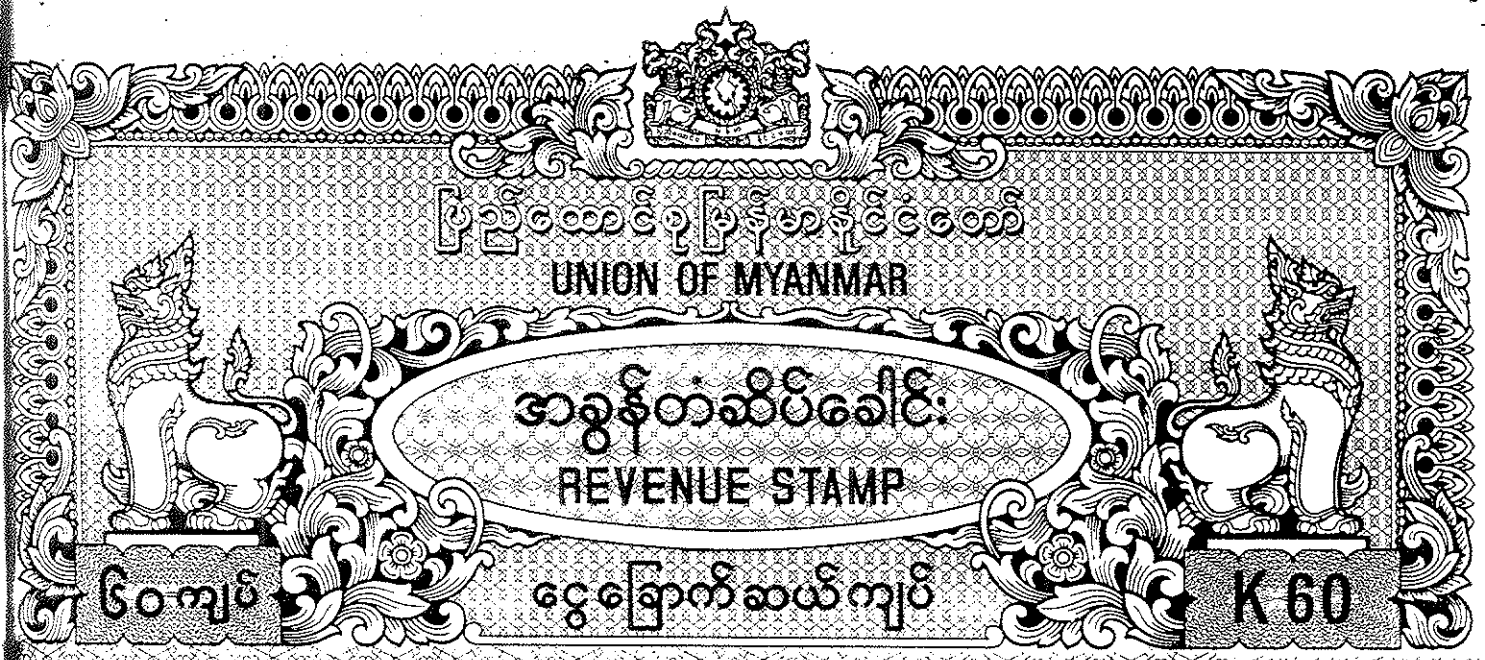


( အထက်အမည်ပါ အပိုင်ရောင်းသူ နှင့် အပိုင်ဝယ်သူများဟု ဆိုရာ၌ ၎င်းတို့ ကိုယ်တိုင် အပြင် ၎င်းတို့အသီးသီး၏ နီး/ခင်ပွန်းသားသမီးများ၊ အဖွဲ့စား/အဖွဲ့ခံများ၊ တရားဝင်ကိုယ်စားလှယ်များ၊ ဆက်ခံသူများ၊ လွှဲပြောင်းခြင်း ခံရသူများ၊ အတူနေ မိသားစုဝင်များ၊ တစ်နည်းနည်းဖြင့် ပတ်သက်သူများအားလုံး အကြံပေးဝင်ပါဝင်သည်ဟု နားလည် သဘော ပေါက်ကြပါသည်။)

အောက်ယေးတွင် အသေးစိတ်အတိအကျ ဖော်ပြထားသော မြေနှင့်အိမ်အပါ အဝင် အကျိုးခံစားခွင့်အရပ်ရပ် အားလုံးတို့သည် သက်ဆိုင်ရာဌာနတွင် အထက်အမည်ပါ အပိုင်ရောင်းသူ အိမ်သုံးသုံးရံ အမည်ပေါက်ပိုင်ဆိုင်ထားပြီး လွတ်လပ်စွာ လွှဲပြောင်းချွှဲကြွေး ဦးစွာ ဝန်ခံကတိပြုရောင်းချခြင်းဖြစ်ပါသည်။







(၈)

သို့ဖြစ်ပါ၍ အောက်စာရင်းပါ မြေကွက်နှင့်နေအိမ်အပါအဝင် အကျိုးခံစားခွင့်အရပ်ရပ်အားလုံး တို့သည် အထက် အမည်ပါ ရောင်းချသူသာ တရားဝင်ပိုင်ဆိုင်ထားပြီး ၊ အမွေစား/အမွေခံ၊ အပေါင်အနှံတို့မှ စ၍ အခြားသူတစ်ပါးတို့ထံ ရောင်းချထားခြင်း၊ ပေးကမ်း ထားခြင်း၊ စွန့်လွှတ်ထားခြင်း၊ အာမခံအဖြစ် တင်သွင်းထားခြင်း၊ လျှို့ဝှက်ထားခြင်း၊ တစ်နည်း နည်းဖြင့် လွှဲပြောင်းထားခြင်းတို့မှ ကင်းရှင်းကြောင်း ဝန်ခံလျှက် အောက်စာရင်းပါ ဂရုန်မြေ နှင့် အိမ် အပါအဝင် အကျိုးခံစားခွင့် အရပ်ရပ်တို့ကို အထက်အမည်ပါ အပိုင်ဝယ်သူများသို့ တန်ဖိုးငွေ ကျပ်-၉၁၀,၀၀၀ဝပ်/- (ကျပ်သိန်းကိုးရာတစ်ဆယ်တိတိ)ဖြင့် ရောင်းချရန် ကမ်းလှမ်းချက်ကို အပိုင်ဝယ်သူများမှလည်း ယင်းတန်ဖိုး ငွေဖြင့်ပင် ဝယ်ယူရန် သဘောတူညီ ကြပါသည်။

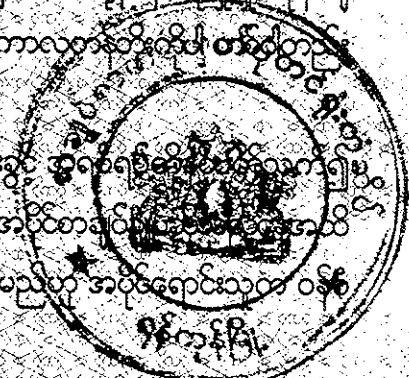
အပိုင်ဝယ်သူများမှဝယ်ယူရန်သဘောတူညီသည့်အတွက် ယနေ့ဤစာချုပ်ချုပ်ဆိုသည့်နေ့တွင် အရောင်းအဝယ် ပြုလုပ်သော မြေကွက်နှင့် ယင်းမြေကွက်ပေါ်ရှိ နေအိမ်အပါအဝင်အကျိုးခံစားခွင့်အရပ်ရပ်အားလုံးတို့၏ တန်ဖိုးငွေ ကျပ်-၉၁၀,၀၀၀ဝပ်/- (ကျပ်သိန်းကိုးရာတစ်ဆယ်တိတိ)ကို အပိုင်ရောင်းသူသို့အပြေအကြေပေးချေရာ အပိုင်ရောင်းသူမှ လည်း တန်ဖိုးငွေ အားလုံးအပြေ အကြေလက်ခံရရှိ ပါကြောင်းဝန်ခံ ပါသည်။

အပိုင်ရောင်းသူမှလည်း မိမိရောင်းချသည့် ပစ္စည်း၏တန်ဖိုးငွေအားလုံးအပြေအကြေလက်ခံရရှိပြီး ဖြစ်သည့် အတွက် မိမိရောင်းချသည့် မြေနှင့်နေအိမ်အပါအဝင်အကျိုးခံစားခွင့်အရပ်ရပ်အားလုံးတို့ကို ပိုင်ဆိုင်မှုစာချုပ်စာတမ်းမူရင်းများ ၊ ပိုင်ဆိုင်မှု အထောက် အထားမူရင်းများ နှင့်အတူ အခြားအခွန် ပြေစာများ အားလုံးတို့ကို ဝယ်ယူသူများသို့ လက်ရောက်လွှဲပြောင်း ပေးအပ်ရာ အပိုင်ဝယ်သူများမှ ကောင်းမွန် ပြည့်စုံစွာ လက်ခံရရှိပါကြောင်း ဝန်ခံကတိ ပြုပါသည်။

ထို့အပြင် အထက်အမည်ပါအပိုင်ရောင်းသူက ထုတ်ဖော်ခံသည်မှာ မိမိရောင်းချ လိုက်သော အောက်စာရင်းပါပစ္စည်းနှင့် ပတ်သက်၍ တစ်နည်းနည်းဖြင့် အရှုပ်အရှင်တစ်စုံတစ်ရာပေါ်ပေါက်လာပါက အထက်အမည်ပါ အပိုင် ရောင်းချသူက မိမိတို့စရိတ်ဖြင့် ပြီးဆုံးပြေလည်သည်အထိ လိုက်လံထုချေ ဖြေရှင်းပေးပါမည်။ အကယ်၍ယင်းကဲ့သို့ ၊ လိုက်လံထုချေ ဖြေရှင်းပေးပါလျက် ပြီးပြတ်ဘဲ အပိုင်ဝယ်သူများတွင် ပစ္စည်းလက်လွှတ်နစ်နာဆုံးရှုံးခဲ့ပါလျှင် ယင်းသို့နစ်နာဆုံးရှုံးမှု ကုန်ကျ စရိတ်နှင့် အရပ်ရပ်သောစရိတ်၊ ကြေးငွေများနှင့်အတူ အရောင်းအဝယ်ပြုလုပ်သည့် ပစ္စည်း၏ကာလတန်ဖိုးကိုပါ တစ်စုံတစ်ဦး ပြန်လည် ပေးလျှော်ပါမည်ဟု အပိုင်ရောင်းသူက ဝန်ခံကတိပြုပါသည်။

တစ်ဖန် အောက်စာရင်းပါ မြေနှင့် ယင်းမြေပေါ်ရှိ နေအိမ်အပါအဝင် အကျိုးခံစားခွင့် အရပ်ရပ်အားလုံးတို့ကို အပိုင်ရောင်းသူမှ ပေးဆောင် ရန်ရှိသော အရပ်ရပ်သောရောင်းခွန် ၊ စည်ပင်သာယာခွန်/အခများကို ဤအပြီးအပိုင်စာချုပ် ပြုလုပ်သည့်နေ့မှစ၍ ကြေးကျန်မရှိစေဘဲ အပြေအကြေပေးချေထားရန် ကျန်ရှိပါကလည်း ထပ်မံပေးဆောင်ပါမည်ဟု အပိုင်ရောင်းသူက ဝန်ခံ ကတိပြုပါသည်။

ထို့အပြင် ဤစာချုပ်ပြီးဆုံးအောင်မြင်ပြီးနောက်၊ ရန်ကုန်မြို့တော်စည်ပင်သာယာရေးကော်မတီ ၊ ရန်ကုန်မြို့ စာချုပ် စာတမ်းမှတ်ပုံတင်ရုံး နှင့် အခြားသက်ဆိုင်ရာ ရုံးဌာနအသီးသီး တို့တွင် အပိုင်ဝယ်သူများ အမည်ပြောင်းလျှောက်ထား သည့်အခါတွင်လည်း လိုက်ပါကူညီဆောင်ရွက် ပေးမည်ဖြစ်ကြောင်း အပိုင်ရောင်းသူက ဝန်ခံကတိပြုပါသည်။



အမည်	.....
အမျိုးသားမှတ်ပုံတင်အမှတ်	.....
ရောင်းချသည့်ရက်ရက်	.....
တံဆိပ်ခမ်းအမှတ်	.....
အမှတ်အသား	.....
ရောင်းချသည့်နေရာ	.....

ကချော့တိုင်းမြို့နယ်၊ သေချာကွက်...  
မိမိက...  
အချက်...  
အချက်...  
အချက်...  
အချက်...



၁၄၇၇

အချက်...  
၁၂/၇၈၄(၇၆)၁၂၂၁၁၇

SP အမှုတွဲ (၁၁၈၇၈/၁၁၁၁) အကျဉ်းချုပ်  
ပထမမြောက်ရက်...  
အချက်...

အချက်...  
အချက်...  
အချက်...  
အချက်...  
အချက်...  
အချက်...



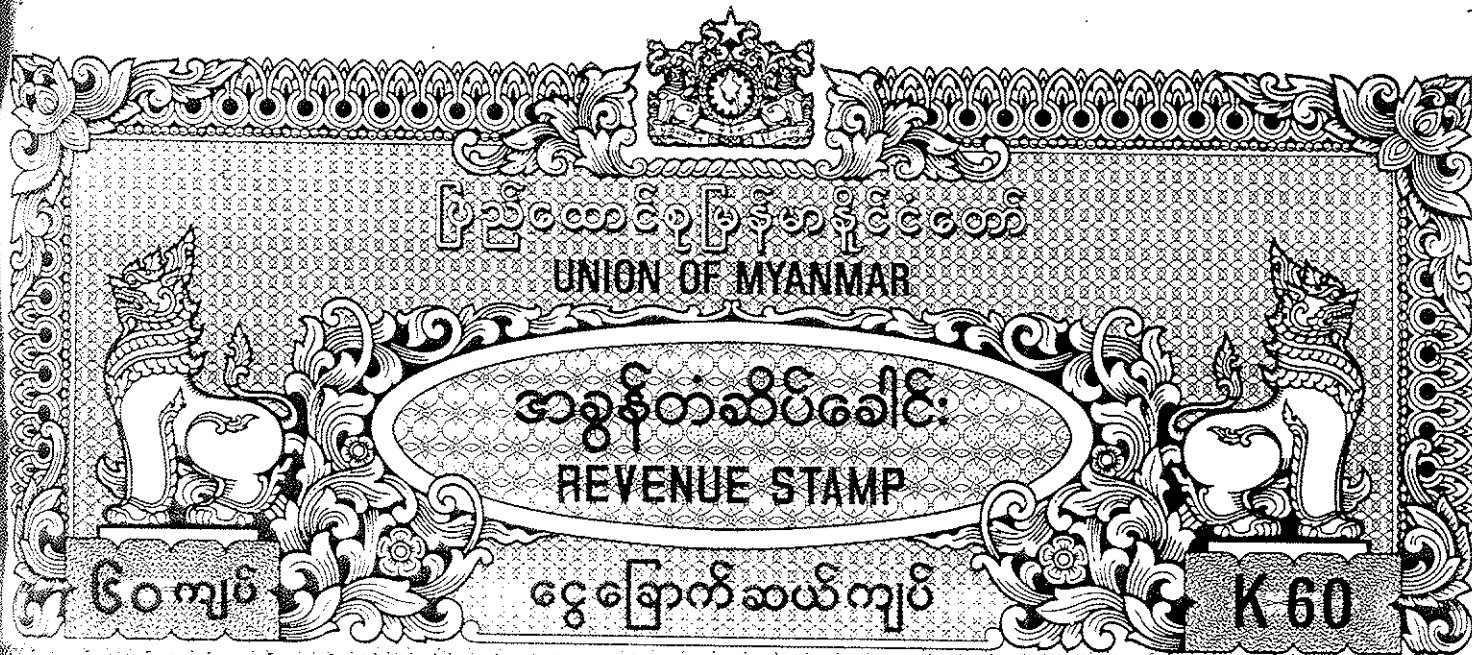
၁၄၇၇

အချက်...  
၁၂/၈၈၄(၇၆)၁၄၇၁၇

အချက်...  
၁၂/၈၈၄(၇၆)၁၄၇၁၇

ကချော့တွင်ပါရှိသည့်...  
အချက်...  
အချက်...  
အချက်...

အချက်...  
အချက်...  
အချက်...  
အချက်...



(၇)

အရောင်းအဝယ်ပြုလုပ်သည့်ပစ္စည်း

ရန်ကုန်တိုင်းဒေသကြီး ၊ ကမာရွတ်မြို့နယ် ၊ မြေတိုင်းရပ်ကွက်အမှတ်(၃၆-အီး) ၊ မြေကွက်အမှတ်(၁၀၂ ဇီ/၄၀) ၊ မြေဧရိယာ (၀.၀၂၉)ဧကရှိ ၊ မြေပိုင်မြေကွက် (မစိုက်ပျိုးမြေ) ၊ မြေကွက်နှင့်လမ်းမြေကွက်ပေါ်ရှိ အမှတ်(၄၀)၊ အောင်မင်းခေါင်ဘုရားလမ်း ၊ (၁၀)ရပ်ကွက် ၊ စာမာရွတ်မြို့နယ်၊ ရန်ကုန်မြို့တို့ ခေါ်တွင်သည့် (၁)ထပ်(တိအင်န်)တိုက်(၁)လုံး အပါအဝင် လမ်းတို့နှင့်ဆက်စပ်ပတ်သက်လျက်ရှိသည့် အကျိုး ခံစားခွင့်အရပ်ရပ်အားလုံးတို့ ပြင်ပါသည်။

အထက်စာချုပ်ပါစကားရပ်များကို အထိုကောင်းချသနှင့် အထိုဝယ်သူများတို့ ကိုယ်တိုင် ဖတ်ရှုနားလည်သဘောပေါက်ကြပြီး မိမိတို့၏လွတ်လပ်သောသဘောဆန္ဒနှင့်အညီ အောက်ဖော်ပြပါ အသိသက်သေများ ရှေ့မှောက်တွင် ဤ“မြေ နှင့်နေအိမ် အပြီးအပိုင် အရောင်းအဝယ်စာချုပ်”ကို လက်မှတ် ရေးထိုးပြုလုပ်ချုပ်ဆိုကြပါသည်။

အသိသက်သေများ

အပိုင်ရောင်းချသူ

၁။

အမည် - အေးနင်းသခင်ထွန်း(ဘ)ဦးစိုးဇော်  
 နိုင်ငံသား - ၁၂/လမန (နိုင်) ၁၄၈၂၁၇  
 တိုက်-၁၊အခန်း (၂၀၃)၊ ကွေ့မအိမ်ရာ၊ ရော့ဇက်လမ်း၊  
 (၂၂)ရပ်ကွက်၊ ဒဂုံမြို့သစ်(တောင်ပိုင်း)မြို့နယ် ၊ ရန်ကုန်မြို့။

အေးသင်းသင်းရီ

(၎င်း၏ကိုယ်စား ရန်ကုန်မြို့စာချုပ်စာတမ်း မှတ်ပုံတင်ရုံး၏အထူးတိုက်ရိုက်လွှဲပြောင်းအမှတ်(၁၁၈၇၈/၂၀၁၃) အရ အိမ်နီးလူမော်(၁၂/ရကန (နိုင်) ၀၂၂၃၁၇)မှ လက်မှတ်ရေးထိုးချုပ်ဆိုပါသည်။)

အပိုင်ဝယ်ယူသူများ

၂။

အမည် - မောင်မြတ်စုံ(အ)ဦးဌေးဦး၊ ဒေါ်ခင်မြ(မ)ဦး၊ (က)ဦးအောင်ဦး၊ ဦးခိုင်ဝင်း  
 နိုင်ငံသား - ၁၂/လမက (နိုင်) ၀၈၉၉၄၄ ၊ ၁၂/လမန (နိုင်) ၀၉၁၉၂၅  
 တိုက်(၇)၊ အခန်း(၁၆)၊ အဆုတ်လမ်းရပ်ကွက်၊  
 မင်္ဂလာတောင်ညွန့်မြို့နယ် ၊ ရန်ကုန်မြို့။

၂။ အိမ်နားလွင်



အမည်	အဘအမည်
အမျိုးသားမှတ်ပုံတင်အမှတ်	
ရောင်းချသည့်ရက်စွဲ	
ကုန်ပစ္စည်းအမျိုးအမည်	
ရောင်းချသူ၏နေရပ်လိပ်စာ	
ရောင်းချသူ၏လက်မှတ်	

ရန်ကုန်တိုင်းမြေစာရင်းဦးစီးဌာန၏( ၁၂/၁၀/၁၃ )  
 နေ့စွဲပါ စာအမှတ် ...၁၂၁၂၃...၁၂၃... အရ  
 ယာယီစာချုပ်အမှတ် (၁၆၅၅ / ၁၃ ) အား  
 တန်ဖိုးငွေ ၉,၀၀,၀၀၀ ( နှစ်ဆယ်လက်  
 သတ်မှတ်ပြီးဖြစ်၍ တင်ပြတန်ဖိုးအတိုင်း ဆက်လက်  
 မှတ်ပုံတင်ခွင့်ပြုသည်။

စာချုပ်စာတမ်းမှတ်ပုံတင်ဌာနမှူး  
 နေ့စွဲ ၁၂.၁၀.၁၃ စာချုပ်စာတမ်းမှတ်ပုံတင်ရုံး  
 ရန်ကုန်မြို့။

၁၀.၁၃. နံနက်၊ စာချုပ်အမှတ် ...၁၀၀၄၂... အား  
 စာချုပ်စာတမ်းများမှတ်ပုံတင် စာအုပ်အမှတ် ...၁၂...  
 အတွက် ၁၂၁၂၃... စာမျက်နှာအမှတ် ၁၂၂၂၂၂၂၂၂၂၂၂၂၂  
 တွင် မှတ်ပုံတင်ထားသည်။

စာချုပ်စာတမ်းမှတ်ပုံတင်ဌာနမှူး  
 နေ့စွဲ ၁၂.၁၀.၁၃... စာချုပ်စာတမ်းမှတ်ပုံတင်ရုံး  
 ရန်ကုန်မြို့။







ပြည်ထောင်စုမြန်မာနိုင်ငံတော်

ရန်ကုန်မြို့တော်စည်ပင်သာယာရေးကော်မတီ

စာချုပ်စာတမ်းမှတ်ပုံတင်ဌာန

နေ့စွဲ: ၂၀၁၃.၁၁.၁၃

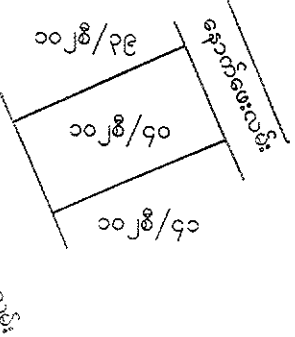
စာချုပ်စာတမ်းမှတ်ပုံတင်ဌာန

ကမက/ပုံ-၂၅၄၄/၁၃

(၂၄၄၄၄၄)

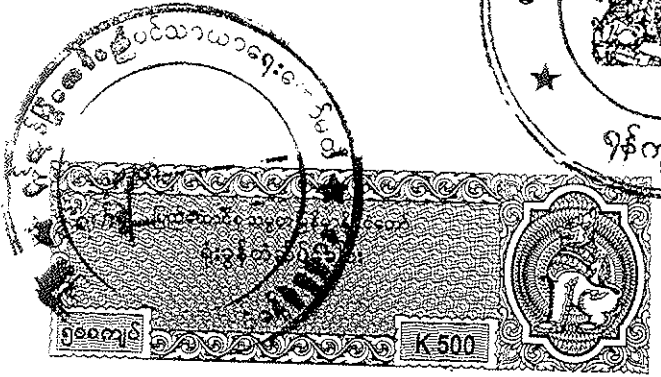


Handwritten signatures and notes on the left side of the document.



Handwritten signature in the middle left area.

Handwritten text below the signature: မြို့ပြစီမံကိန်းနှင့် မြေစီမံခန့်ခွဲမှုဌာန



၂၀၁၃ / ၂၀၁၄ ခုနှစ် သုံးမြေပုံမှ ရေးကူးပေးသည့် မှန်ကန်ကြောင်း သက်သေခံသည့် မိတ္တူမြေပုံ	
အမည်ပေါက်	ဒေါ်သင်းသင်းရှိ ၁၂/ကမရ(နိုင်)၀၀၇၄၃၀
မြေတိုင်းရပ်ကွက်အမှတ်	36-E
လူနေရပ်ကွက်အမှတ်	-
မြေကွက်အမှတ်	၁၀၂၈/၄၀
မြေအမျိုးအစား	မြေပိုင်မြေ မစိုက်ပျိုးမြေ
မြေအတိုင်းအတာ (အလျား x အနံ) ဧရိယာ	၀. ၀၂၉ ဧက
မြို့နယ်	ကမာရွတ်မြို့နယ်
စကေး	1:600
လျှောက်ထားသည့်အကြောင်းအရာ	
အရောင်းအဝယ်စာချုပ်ချုပ်ဆိုရန်	
<p>၂၀၁၃.၁၁.၁၃</p> <p>မြို့နယ်တာဝန်ခံ (ကွန်ပျူတာ)</p> <p>မြို့ပြစီမံကိန်းနှင့် မြေစီမံခန့်ခွဲမှုဌာန</p>	
<p>Handwritten signature: Mya Aye Win</p> <p>26.6.2013</p> <p>မြေတိုင်း (၂)</p> <p>မြို့ပြစီမံကိန်းနှင့် မြေစီမံခန့်ခွဲမှုဌာန</p>	
<p>Handwritten signature: Mya Aye Win</p> <p>26.6.2013</p> <p>မြို့နယ်တာဝန်ခံ (ကွန်ပျူတာ)</p> <p>မြို့ပြစီမံကိန်းနှင့် မြေစီမံခန့်ခွဲမှုဌာန</p>	

၂၀၁၃ / ၂၀၁၄ ခုနှစ်သုံးမြေပုံ/မြို့မြေစာရင်းမှ ရေးကူးသော ကောက်နုတ်ချက် မိတ္တူ မြေပုံ/မြေရာထောင် ဖြစ်၍ တိကျ မှန်ကန်ကြောင်း ထောက်ခံပါသည်။  
(မြို့ပြစီမံကိန်း နှင့် မြေစီမံခန့်ခွဲမှုဌာန)





၂၀၀၈ခုနှစ် ပြည်ထောင်စုသမ္မတမြန်မာနိုင်ငံတော်ဖွဲ့စည်းပုံ အခြေခံ ဥပဒေပုဒ်မ ၃၈၉ အရ နိုင်ငံသားတိုင်းသည် ဥပဒေအရ ပေးဆောင် ရမည့်အခွန်အကောက်များကို ငွေပေးဆောင်ရန် တာဝန်ရှိသည်။

အခွန်ပေးဆောင်မှုအတွက် အထူးပင်ကျေးဇူးတင်ရှိပါသည်။

ပတခ(ဝင)၁၉။

(ငွေပေးသွင်းသူအဖြစ် ဖော်ပြရန်)

ဒေါ်မိမိဖြိုးကျော်

အခွန်ထမ်းလုပ်ငန်း မှတ်ပုံတင်အမှတ်

17203/MCO/၂၀၁၈-၂၀၁၉

အခွန်ထမ်းအမည်နှင့်လိပ်စာ

I M C S (Institute Of Management & Computer Studies) Co., Ltd

အမှတ်-(၂၁/၂၃) ဒုတိယထပ်ဦးထွန်းလင်းခြံလမ်း၊ ကမာရွတ်

၂၀၁၈-၂၀၁၉

စည်းကြပ်နှစ်အတွက် ဝင်ငွေခွန်

ကျပ်

5397536

နှင့်ဒက်ငွေကျပ်

0

စုစုပေါင်း(ဂဏန်းဖြင့်)

5397536

(စာဖြင့်)ကျပ်

ငါးသန်းသုံးသိန်းကိုးသောင်းခုနစ်ထောင်ငါးရာသုံးဆယ့်ခြောက် ကျပ်

ပေးသွင်းသဖြင့် လက်ခံရရှိပါသည်။

ရက်စွဲ၊

14 May 2019

မြန်မာစီးပွားရေးဘဏ်

ဘဏ်ခွဲ(၂)၊ ရန်ကုန်မြို့

ငွေခွဲ

လက်ခံရရှိငွေ

8-5397536/

ဘဏ်မန်နေဂျာ

ငွေကိုင်

14 May 2019

မန်နေဂျာ

ဘဏ်တံဆိပ်

အခွန်ဆောင်ထားနိုင်ငံသား  
လေးစားသမှုတို့ဂုဏ်ပြု

အခွန်နှင့် ပတ်သက်သော အခွန်ကောက်ခံမှုနှင့် ပတ်သက်သည့် အခွန်ကောက်ခံမှုများကို ပေးဆောင်ရန် တာဝန်ရှိသည်။

အခွန်ပေးဆောင်မှုအတွက် အထူးပင်ကျေးဇူးတင်ရှိပါသည်။  
ပတာခ(ဝင)၂၉။

(ဖွဲ့စည်းခွင့်သို့ ပြန်လေးရန် ဖြတ်ပိုင်း)

၄၈၄(၂)

MD-010145

ဒေါ်မိမိမော်

အခွန်တမ်းလုပ်ငန်း မှတ်ပုံတင်အမှတ်

၁၇၂၀၃/MCO/၂၀၁၇-၂၀၁၈

အခွန်တမ်းအမည်နှင့်လိပ်စာ

I M C S (Institute Of Management & Computer Studies) Co., Ltd

အမှတ်-(၂၁/၂၃) ဒုတိယထပ်ဦးထွန်းလင်းခြံလမ်း၊ ကမာရွတ်၊ ရန်ကုန်တိုင်းဒေသကြီး

၂၀၁၇-၂၀၁၈

စည်းကြပ်နှစ်အတွက် ဝင်ငွေခွန်

ကျပ်

၁၀၂၅၁၇၀

နှင့်ဒက်ငွေကျပ်

၁၀၂၅၁၇

စုစုပေါင်း(ဂဏန်းဖြင့်)

၁၁၂၇၈၇.၀၀

(စာဖြင့်)ကျပ်

တစ်သန်းတစ်သိန်းနှစ်သောင်းခုနစ်ထောင်ခြောက်ရာရှစ်ဆယ်ခုနှစ်ကျပ်

ပေးသွင်းသဖြင့် လက်ခံရရှိပါသည်။

ရက်စွဲ၊ ၂၀၆၀  
31/May/2017

၁၁၇၆၈၇  
ဘဏ်မန်နေဂျာ

ဘဏ်တံဆိပ်

အခွန်ဆောင်ထားနိုင်သော  
လေးစားသမှုတို့ရက်ပြု



၂၀၀၈ခုနှစ် ပြည်ထောင်စုသမ္မတမြန်မာနိုင်ငံတော်ဖွဲ့စည်းပုံ အခြေခံ ဥပဒေပုဒ်မ ၃၈၉ အရ နိုင်ငံသားတိုင်းသည် ဥပဒေအရ ပေးဆောင် ရမည့်အခွန်အကောက်များကို ပေးဆောင်ရန်တာဝန်ရှိသည်။

အခွန်ပေးဆောင်မှုအတွက် အထူးပင်ကျေးဇူးတင်ရှိပါသည်။

ပတာ(၀၀)၁၉။

MD-010145



(လူငယ်သွင်းသူသို့ နှစ်ပေးရန်ဖြတ်ပိုင်း)

ဒေါ်မိမိမော်

အခွန်ထမ်းလုပ်ငန်း မှတ်ပုံတင်အမှတ်

၁၇၂၀၃/MCO/၂၀၁၆-၂၀၁၇

အခွန်ထမ်းအမည်နှင့်လိပ်စာ

I M C S (Institute Of Management & Computer Studies) Co., Ltd

အမှတ်-(၂၁/၂၃)ဒုတိယထပ်ဦးထွန်းလင်းမြို့လမ်း၊ ကမာရွတ်၊ ရန်ကုန်တိုင်းဒေသကြီး

၂၀၁၆-၂၀၁၇

စည်းကြပ်နှစ်အတွက် ဝင်ငွေခွန်

ကျပ်

၆၆၀၇၅၀

နှင့်ဒဏ်ငွေကျပ်

၆၆၀၇၅

စုစုပေါင်း(ဂဏန်းဖြင့်)

၇၂၆၈၂၅.၀၀

(စာဖြင့်)ကျပ်

ခုနှစ်သိန်းနှစ်သောင်းခြောက်ထောင်ရှစ်ရာနှစ်ဆယ့်ငါး ကျပ်

ပေးသွင်းသဖြင့် လက်ခံရရှိပါသည်။

၃-၆-၁၇

ရက်စွဲ၊

31/May/2017

ဘဏ်မန်နေဂျာ

ဘဏ်တံဆိပ်

အခွန်ဆောင်ထားနိုင်သော  
လေးစားသမှုတို့ဂုဏ်ပြု



**Info Myanmar University (IMU)**

ပုဂ္ဂလိက ကျောင်းအမျိုးအစား၊  
ကျောင်းအမျိုးအစားအလိုက် ထားရှိမည့်  
ပရဂျက်၏ အကျယ်အဝန်း





AYA Bank  
အထူးစီးပွားဘဏ်

Edinburgh Napier  
UNIVERSITY

INFO MYANMAR  
COLLEGE

BTEC  
HIGHER NATIONAL  
DIPLOMA  
COMPUTING UK  
HND

INFO MYANMAR COLLEGE





INFO MYANMAR COLLEGE







Edinburgh Napier  
UNIVERSITY

MYANMAR CAMPUS

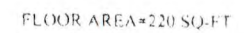
Edinburgh Napier  
UNIVERSITY



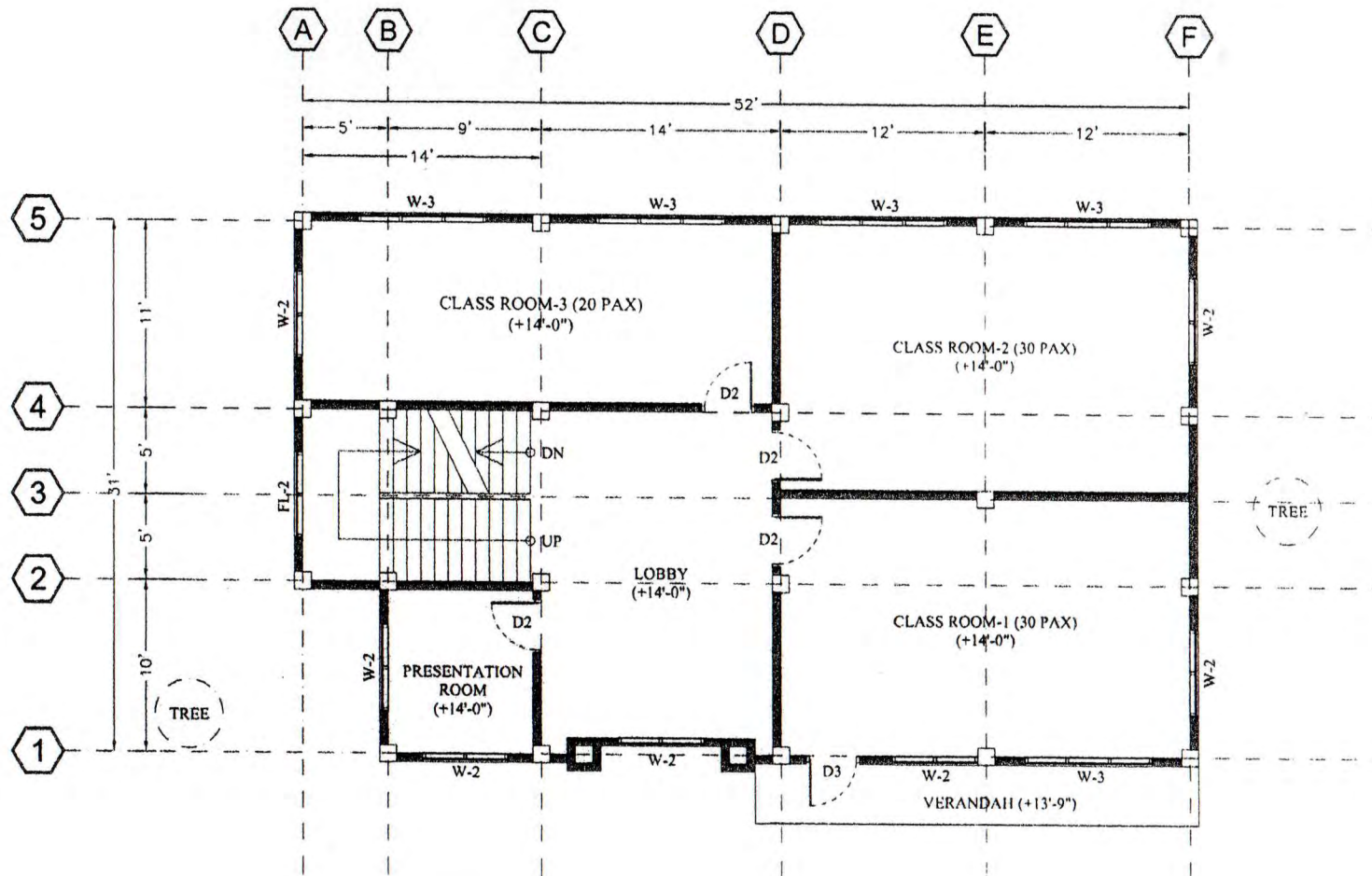


INFO MYANMAR COLLEGE





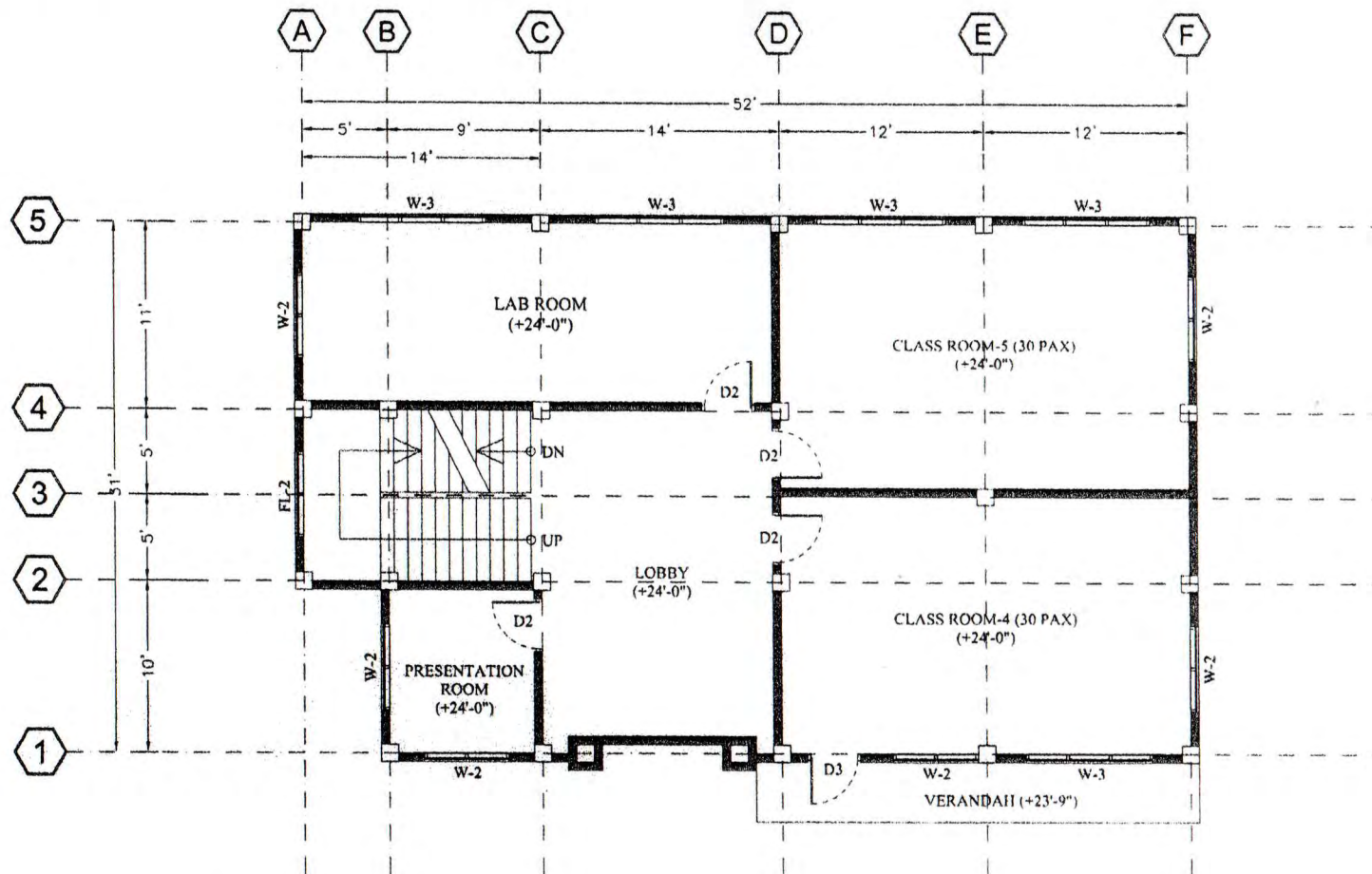
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PROJECT				
PROPOSED (3) STOREYED RCC BUILDING				
TITLE				
ROOF TOP LAYOUT PLAN				
DRG NO	SCALE 1/4"=1'-0"		SHEET NO	
DATE	DRAWN BY	DAI	CHECKED BY	MC
OWNER				
INFO MYANMAR COLLEGE				
BUILDING				
To be advised				
DESIGNER				
INFO MYANMAR COLLEGE				



FLOOR AREA=1660 SQ-FT

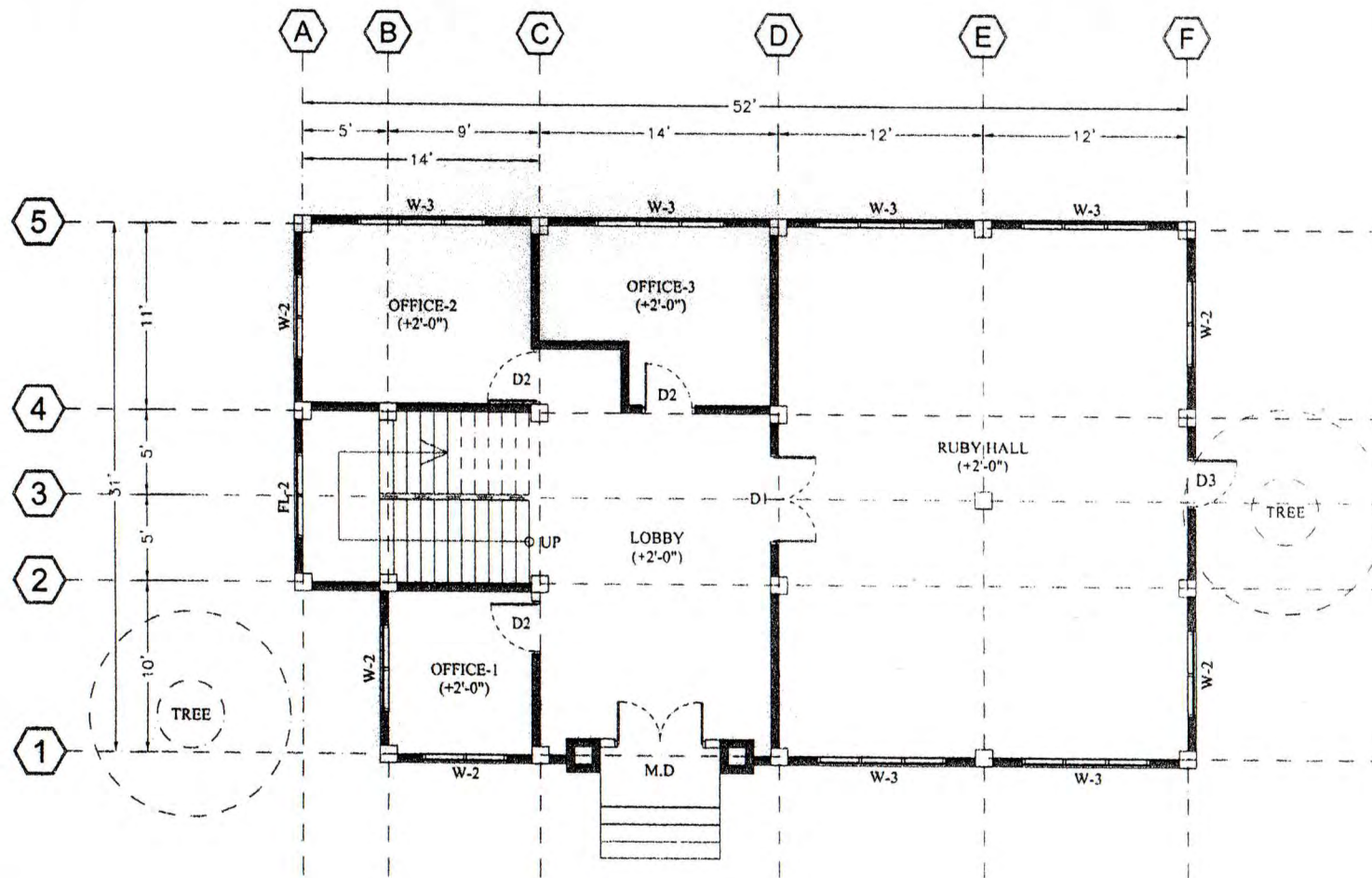
REV	MODIFICATION	BY	CHK'D
PROJECT	PROPOSED (3) STOREYED RCC BUILDING		
TITLE	FIRST FLOOR LAYOUT PLAN		
DRG NO	SCALE 1" = 1/16"		
DATE	DRAWN BY : P.M.	CHECKED BY :	SAC
OWNER	INFO MYANMAR COLLEGE		
BUILDER	To be advised		
DESIGNER	INFO MYANMAR COLLEGE		





FLOOR AREA=1660 SQ-FT

REV	MODIFICATION	BY	DATE
PROJECT	PROPOSED (3) STOREYED RCC BUILDING		
TITLE	SECOND FLOOR LAYOUT PLAN		
DWG NO	SCALE 1"=1'-0"	SHEET	
DATE	DRAWN BY	DATE	CHECKED BY
OWNER	INFO MYANMAR COLLEGE		
BUILDER	To be advised		
DESIGNER	INFO MYANMAR COLLEGE		



FLOOR AREA=1540 SQ-FT

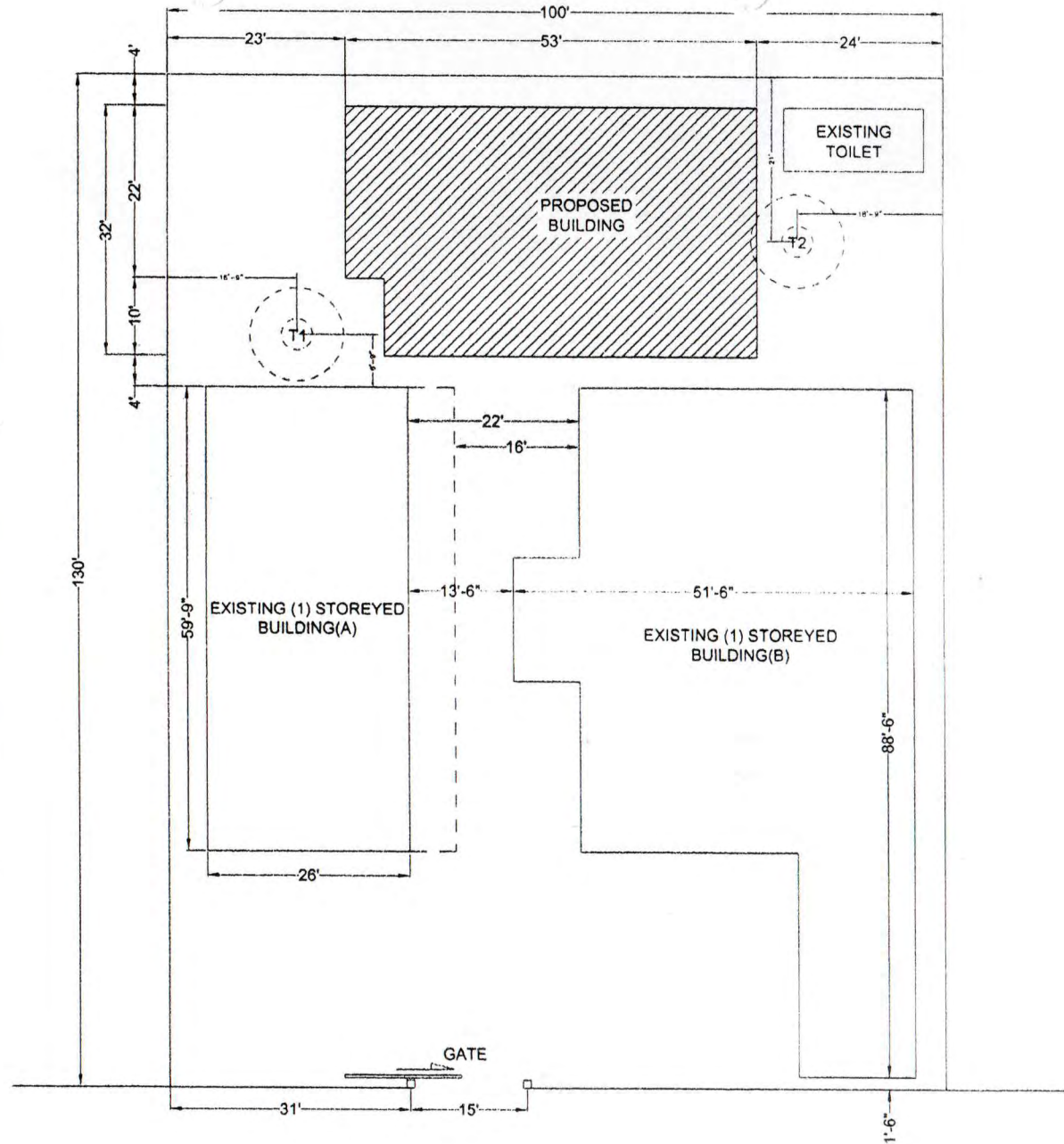
REV	MODIFICATION	BY	CHK'D
PROJECT	PROPOSED (3) STOREYED RCC BUILDING		
TITLE	GROUND FLOOR LAYOUT PLAN		
DRG NO.			SCALE 1"=1/16" 5/11
DATE	DRAWN BY	PAI	CHECKED BY SAC
OWNER	INFO MYANMAR COLLEGE		
BUILDER	To be advised		
DESIGNER	INFO MYANMAR COLLEGE		





PROPOSED SITE

SITE LOCATION PLAN



BUILDING LAYOUR PLAN


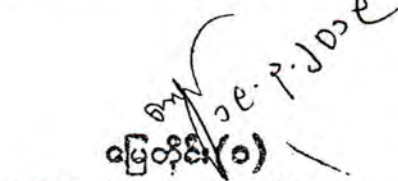
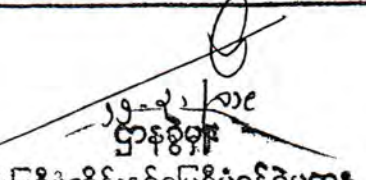
REV.	MODIFICATION	BY	CHK'D
PROJECT			
PROPOSED (3) STOREYED RCC BUILDING			
TITLE			
BUILDING LAYOUT PLAN			
DRG NO		SCALE 1/4" = 1'-0"	
DATE		DRAWN BY DAI	
OWNER		CHECKED BY SA	
INFO MYANMAR COLLEGE			
BUILDER			
To be advised			
DESIGNER			
INFO MYANMAR COLLEGE			

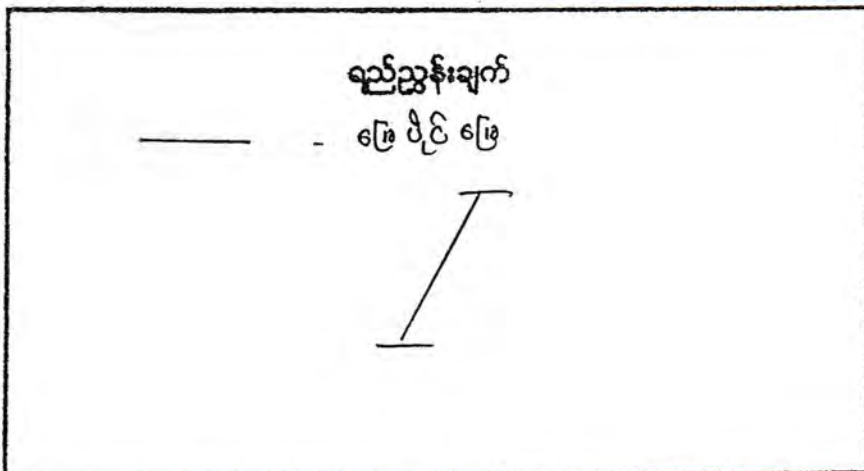
ပြည်ထောင်စုသမ္မတမြန်မာနိုင်ငံတော်

ရန်ကုန်မြို့တော်စည်ပင်သာယာရေးကော်မတီ

နယ်နိမိတ်တိုင်းတာသတ်မှတ်သည့်မြေပုံ



၂၀၁၈/၁၉ / ခုနှစ်သုံးမြေပုံ
အရ တိုင်းတာပေးသည့်မြေတိုင်း
နယ်သတ်မြေပုံ
အမည်ပေါက်
ဦးကောင်းမြတ်ပိုင်
ဒေါ်ဗုဒ္ဓသိန်း
မြေတိုင်းရပ်ကွက်အမှတ် - ၃၆ ခြံ
မြေဧရိယာရပ်ကွက်အမှတ် - ၁၀၂၈/၄၉
မြေအမျိုးအစား - မြေပိုင်မြေ
ဧရိယာ - ၀.၀၂၉ ဧက
မြို့နယ် - ကမာရွတ်
စကေး - ၁" = ၁၀၀' - ၀၀"
နယ်နိမိတ်တိုင်းတာသတ်မှတ်သည့်မြေ
လျှောက်ထားသည့်အကြောင်းအရာ
 မြေတိုင်း(၂) မြို့ပြစီမံကိန်းနှင့်မြေစီမံခန့်ခွဲမှုဌာန
 မြေတိုင်း(၁) မြို့ပြစီမံကိန်းနှင့်မြေစီမံခန့်ခွဲမှုဌာန
 ဌာနမှူး မြို့ပြစီမံကိန်းနှင့်မြေစီမံခန့်ခွဲမှုဌာန



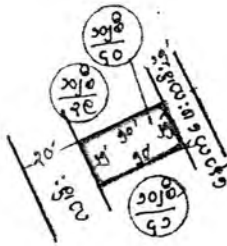
၂၀၁၉.၇.၂၀



ပြည်ထောင်စုသမ္မတမြန်မာနိုင်ငံတော်

ရန်ကုန်မြို့တော်စည်ပင်သာယာရေးကော်မတီ

အမှတ် (၁) ဘက်စုံကုန်သွယ်ရေးဇုန်



၂၀၁၈/၁၉ / ခုနှစ်သုံးမြေပုံ

အရ တိုင်းတာပေးသည့်မြေတိုင်း

နယ်သတ်မြေပုံ

အမည်ပေါက် ဦး ကောင်းမြတ်ပိုင်  
ဒေါ် နုနုသန့်

မြေတိုင်းရပ်ကွက်အမှတ် - ၃၆ ခြံ

လူနေရပ်ကွက်အမှတ် - ၁၀၂၈/၄၀

မြေအမျိုးအစား - ၆၈ ပိုင်မြေ

ဧရိယာ - ၀.၀၂၉ ဧက

မြို့နယ် - ကားလမ်း

စကေး - ၁" = ၁၀၀' - ၀၀"

ခယ်လျက်ပေးသူကုန်သွယ်ရေးဇုန်  
လျှောက်ထားသည့်အကြောင်းအရာ

၂၀၁၉.၇.၂၀  
မြေတိုင်း (၁)

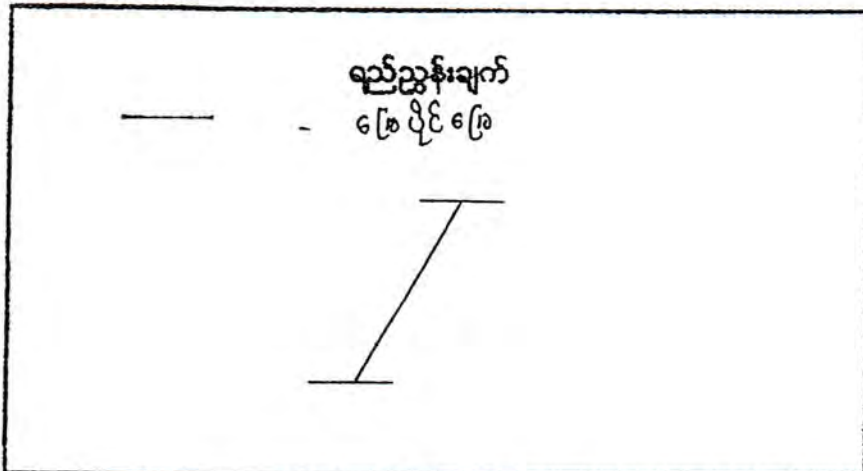
မြို့ပြစီမံကိန်းနှင့်မြေပုံဆွဲမှုဌာန

၂၀၁၉.၇.၂၀  
မြေတိုင်း (၁)

မြို့ပြစီမံကိန်းနှင့်မြေပုံဆွဲမှုဌာန

၂၀၁၉.၇.၂၀  
မြေတိုင်း (၁)

မြို့ပြစီမံကိန်းနှင့်မြေပုံဆွဲမှုဌာန



ရည်ညွှန်းချက်  
မြေပိုင်မြေ

၂၀၁၉.၇.၂၀

# **I M C CAMPUS**

*@ AUNG MIN KHAUNG ST*



# IMC CAMPUS

@ AUNG MIN KHAUNG ST



View from Aung Min Khaung St.1



# IMC CAMPUS

@ AUNG MIN KHAUNG ST



View from Aung Min Khaung St



# IMC CAMPUS

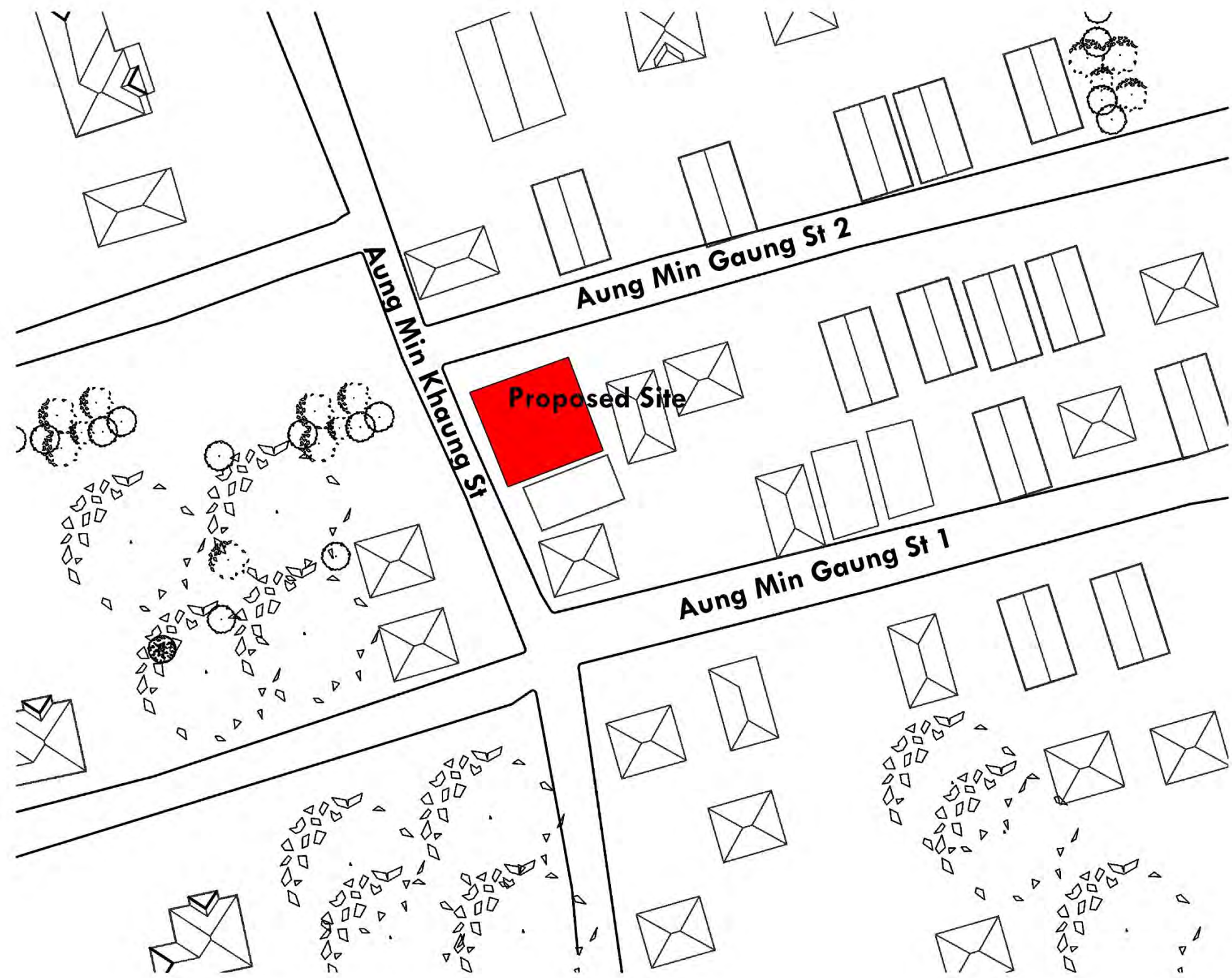
@ AUNG MIN KHAUNG ST



View from Aung Min Khaung St



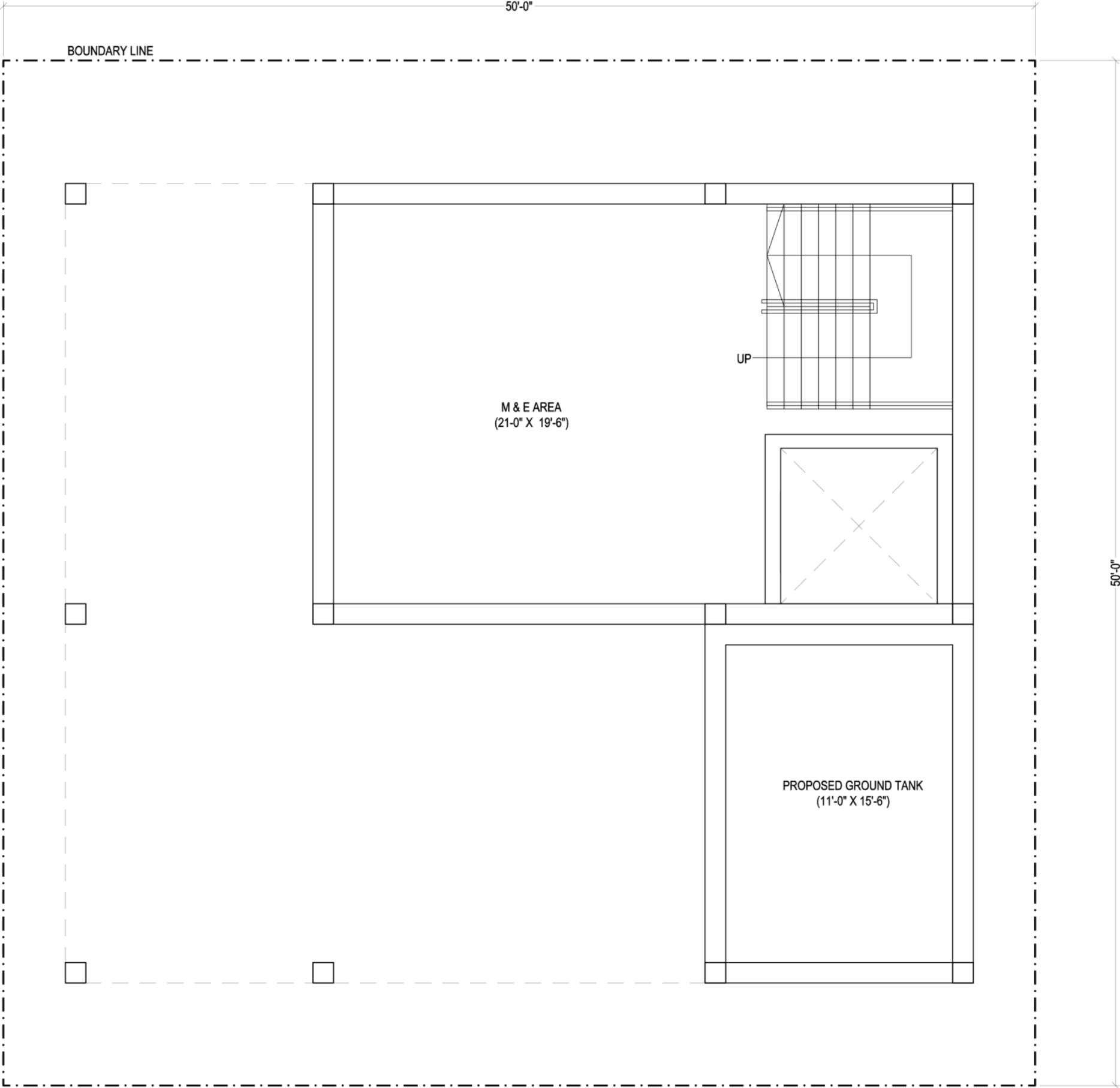
IMC CAMPUS  
@ AUNG MIN KHAUNG ST



Location Map  
Site Area - 2500 sq.ft



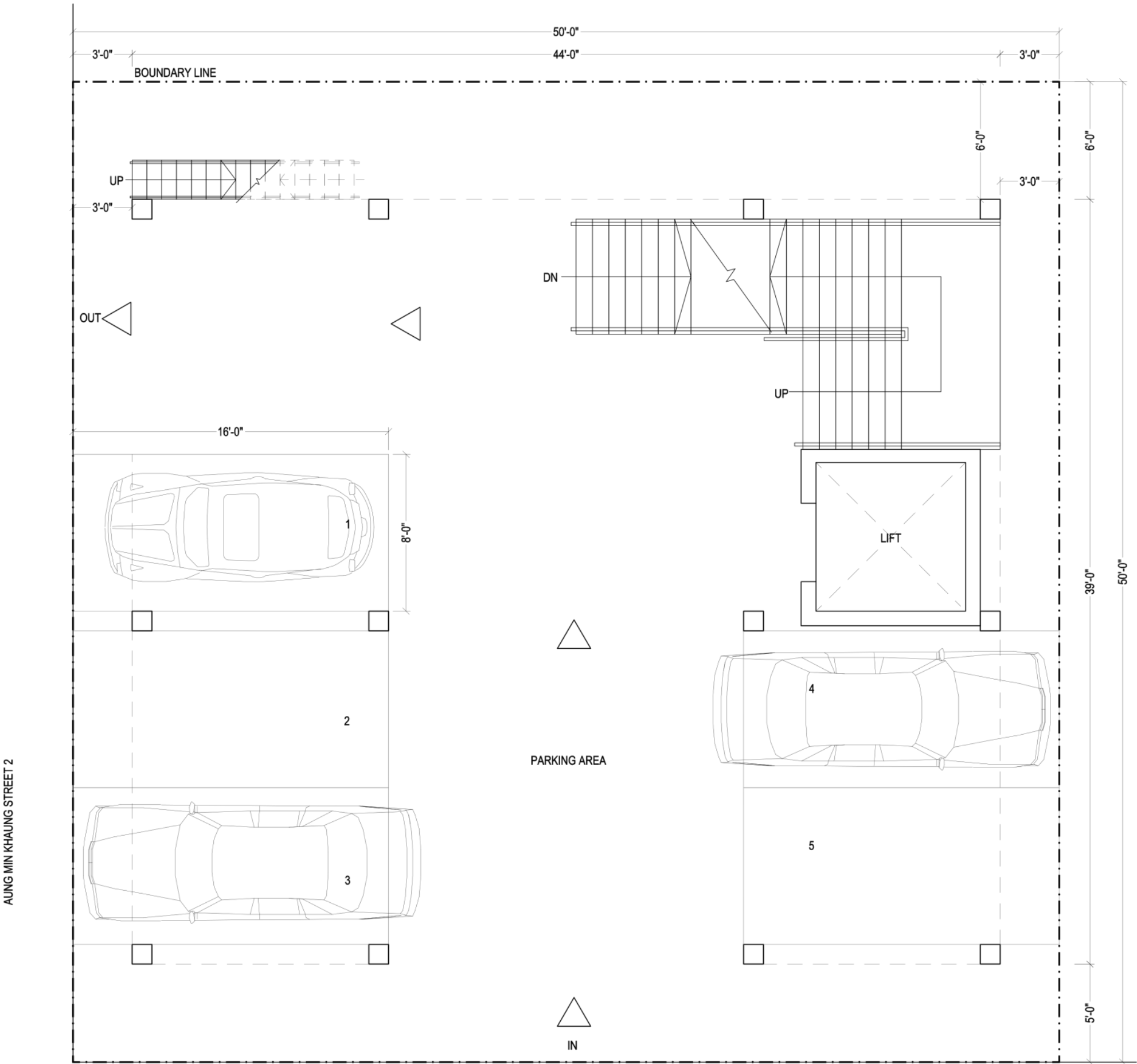
IMC CAMPUS  
@ AUNG MIN KHAUNG ST



Basement Plan

# I M C CAMPUS

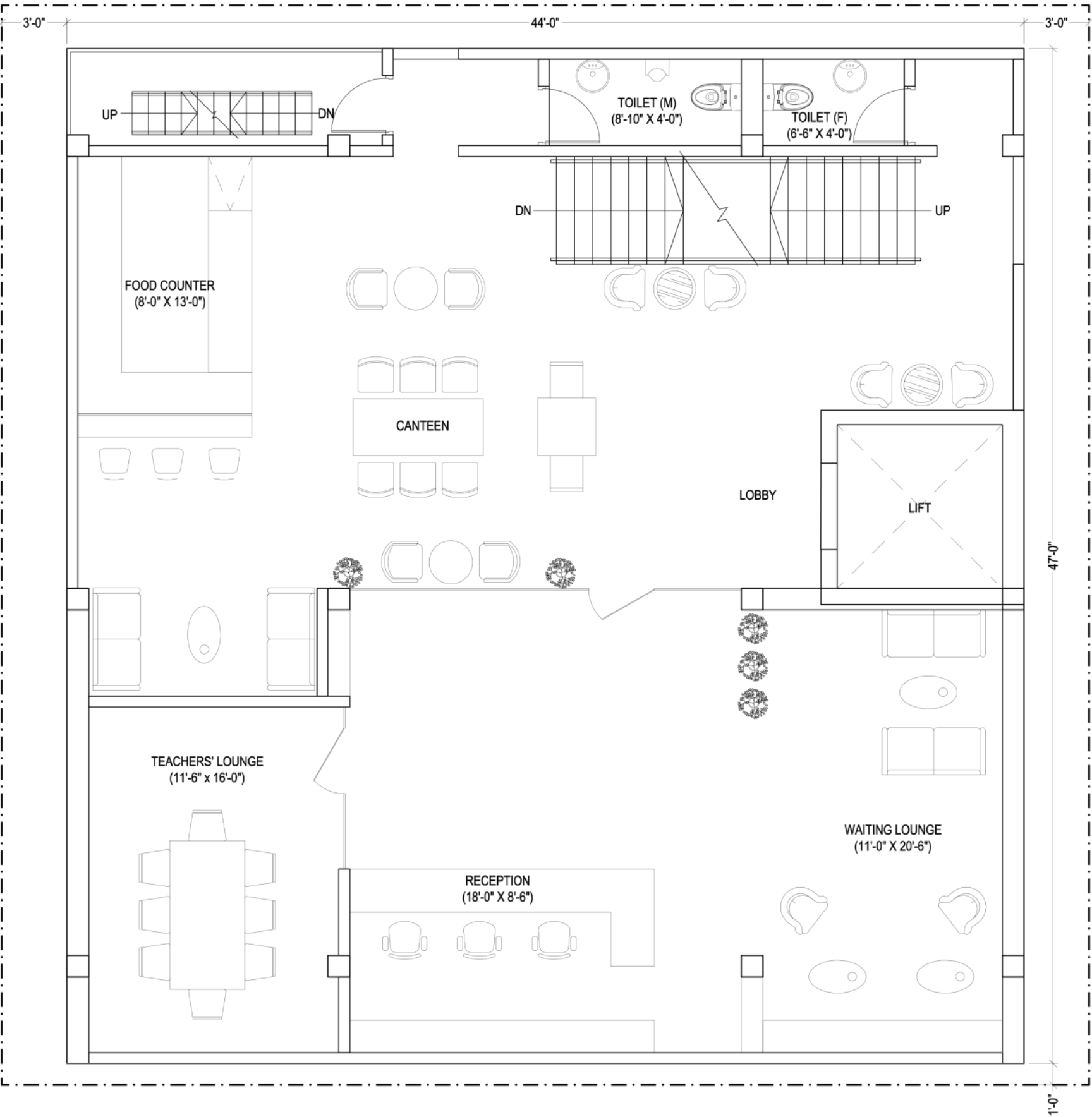
@ AUNG MIN KHAUNG ST



Ground Floor Plan

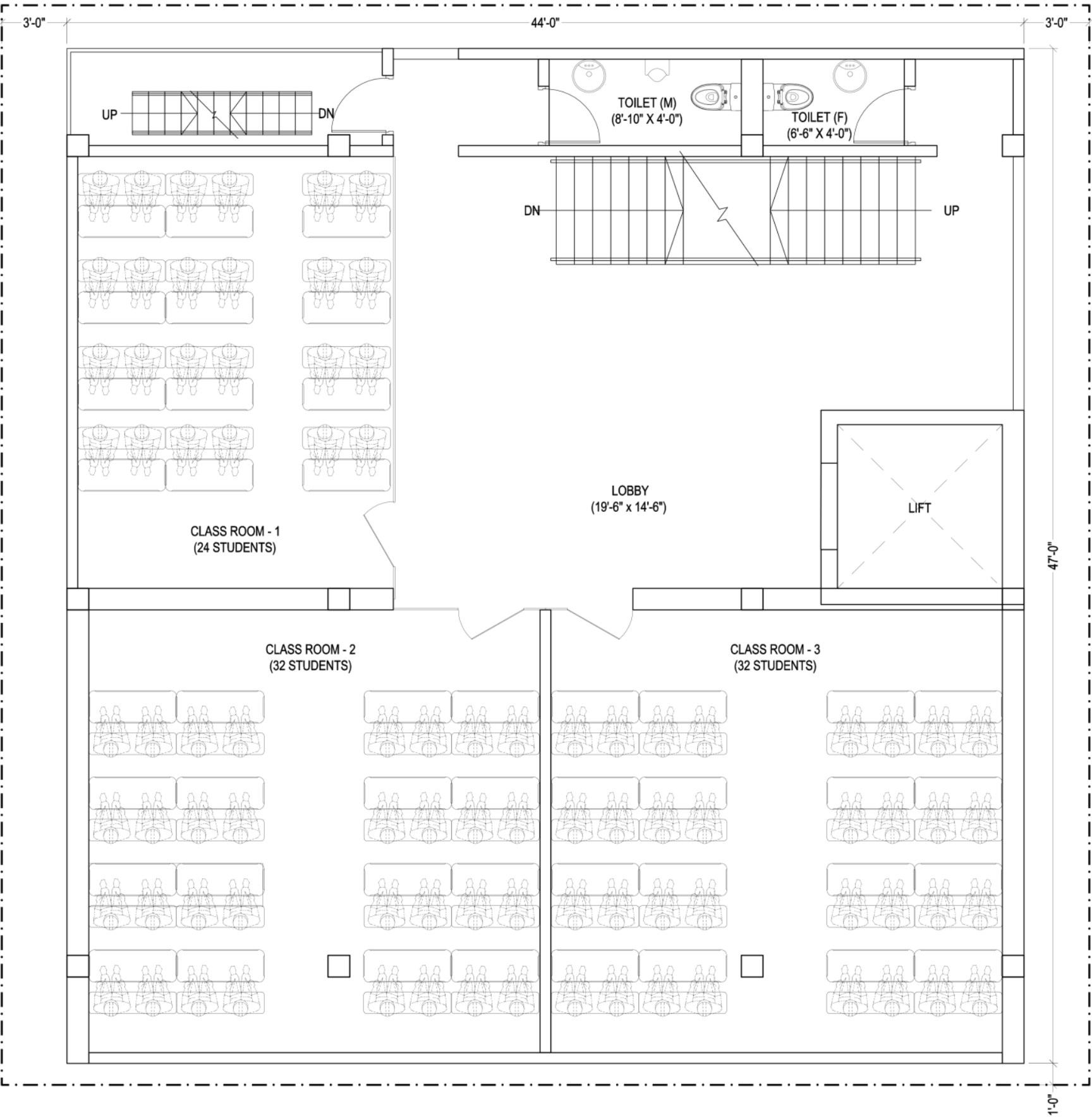


IMC CAMPUS  
@ AUNG MIN KHAUNG ST



First Floor Plan

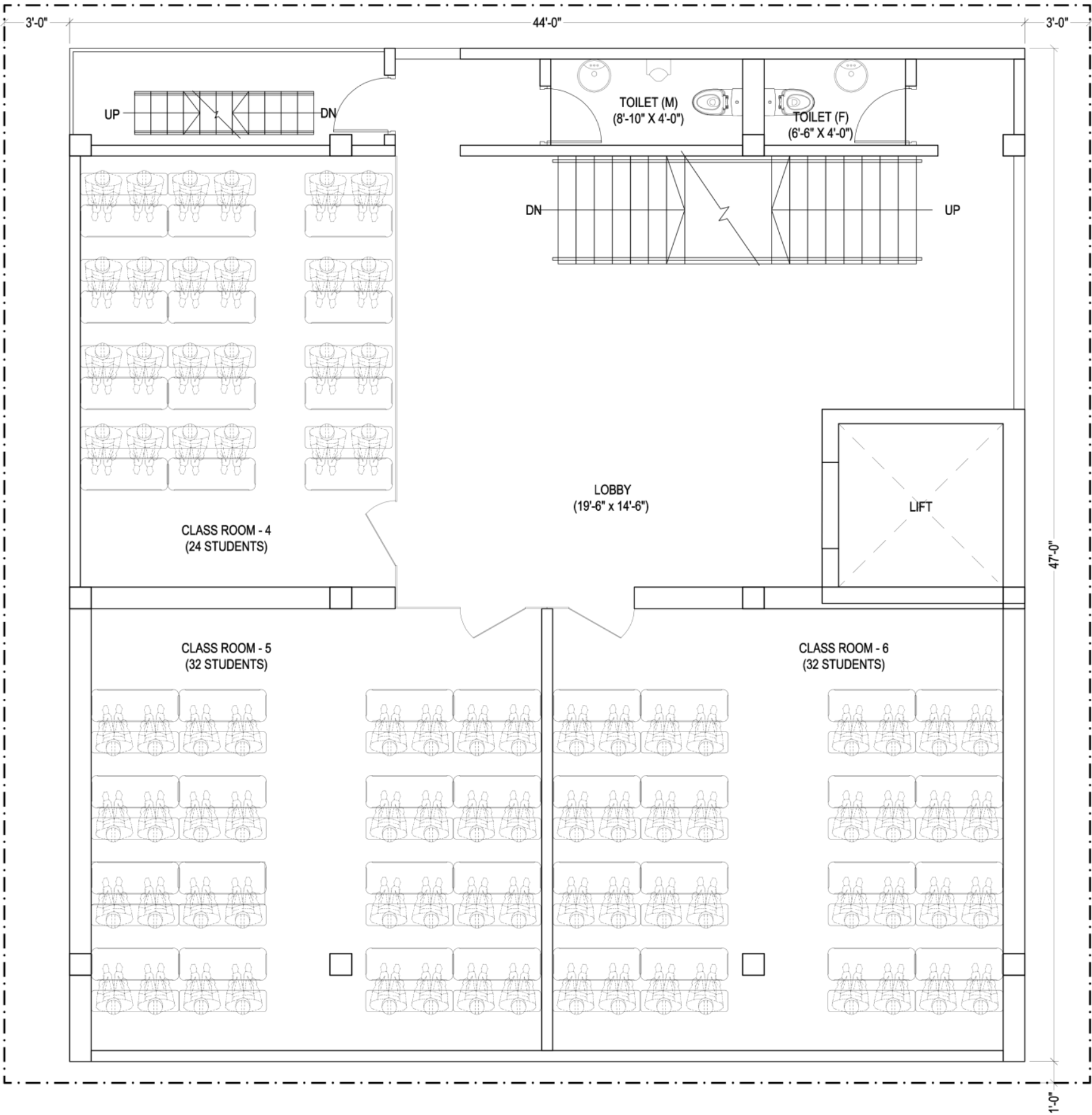
IMC CAMPUS  
@ AUNG MIN KHAUNG ST



Second Floor Plan

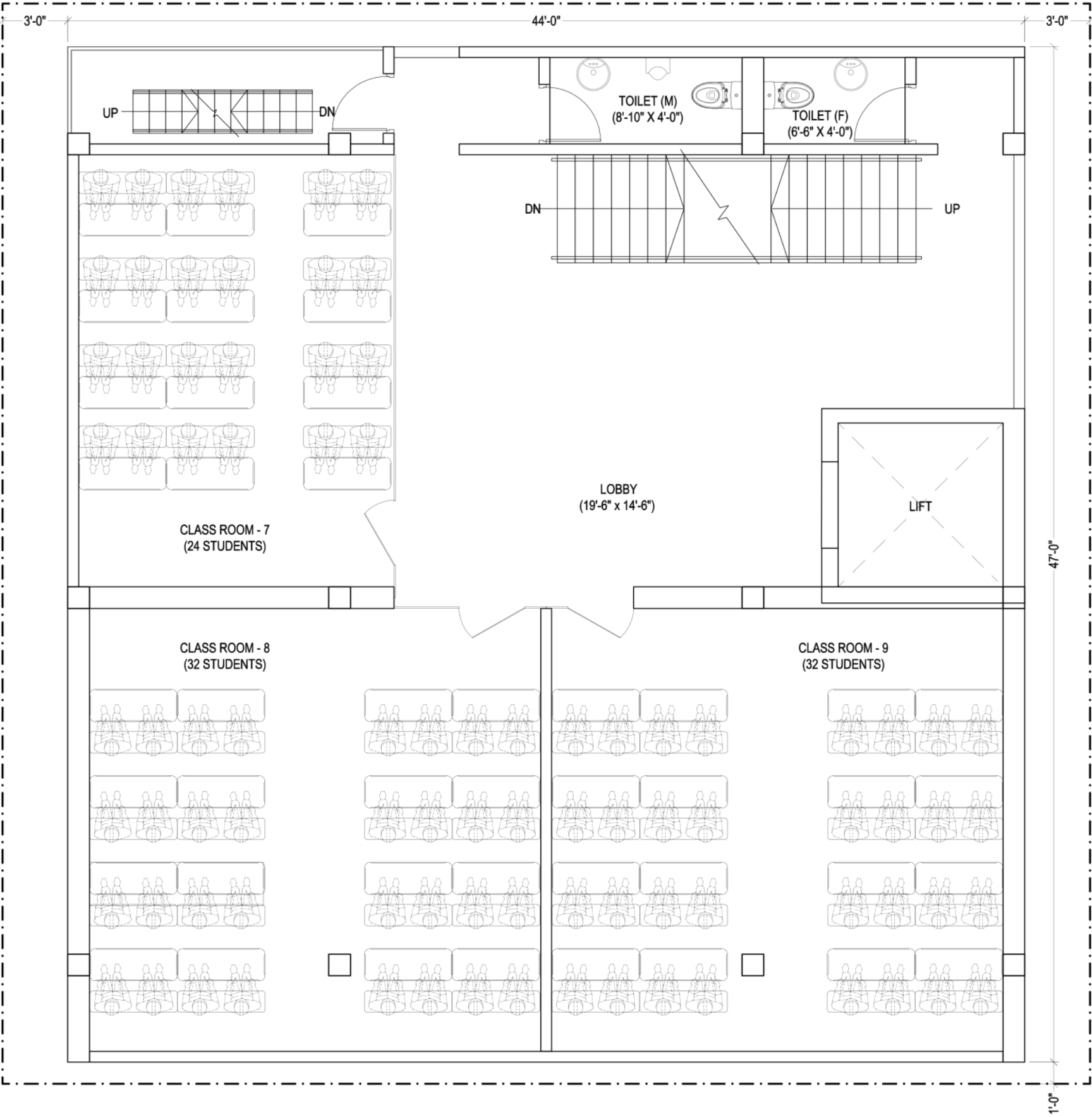


IMC CAMPUS  
@ AUNG MIN KHAUNG ST



Third Floor Plan

IMC CAMPUS  
@ AUNG MIN KHAUNG ST



Fourth Floor Plan





Info Myanmar University (IMU)

စီမံခန့်ခွဲအုပ်ချုပ်မည့် အဖွဲ့အစည်းဝင်များ၏  
ပညာအရည်အချင်း အထောက်အထား နှင့်  
ဘာသာရပ်အလိုက် သင်ကြားမည့်  
ပုဂ္ဂလိက ကျောင်းဆရာ၊ဆရာမများ၏  
ဘွဲ့လက်မှတ်၊ အထောက်အထားများ၊  
သင်ကြားရေး အတွေ့အကြုံများ နှင့်  
ကိုယ်ရေးအကျဉ်း



## **Info Myanmar University (IMU)**

### **Advisory Board**

- U Myo Min                                      Advisory Head
- Prof Dr. San San Mon                      Advisory Board Member
- Prof Dr. Myat Thandar Khin              Advisory Board Member





## Info Myanmar University



**U Myo Min**  
**Advisory Head**

### **Professional Member and Education**

- Committee Member (National SME Agency)President
  - (International Council of Small Business-Myanmar)
- Chartered Marketer & Fellow Member
  - Chartered Institute of Marketing (CIMUK)
- Honorary Fellow the Association of Business Executives (ABE-UK)
- Ex-National President (JCI\_Myanmar)
- Founding Member (Professional Marketers Association\_PMA)
- AOTS Alumni
- Post-graduate diploma Applied Psychology (YU)
- B.A (English)

### **International Exposure**

- Scholar (IMF) attend Annual Conference, International Visiting Leader Program (IVLP) to States, a speaker at Social Enterprise Workshop in Tokyo invited from Nippon Foundation
- Attended Youth Social Network in Australia - A member of Panel Judge at NUS Social Venture Competition
- International Marketing Plan Competition (IMC 09 to 2013) in Singapore
- Global Social Venture Competition (GSVC 2014) in Bangkok
- Social Enterprise Challenge in Cambodia



## **Current Position**

- Founder & Principal of PS Business School; in 2007
- Presenter "Road to Success" Program at Channel7 and "HR Dialogue" at Padamyar FM

## **Track record**

- Introduce Myanmar Business Plan Competition MBPC 2010 & 2011,
- Myanmar Social Enterprise Challenge (MSEC 2013)
- Myanmar IDEA Challenge (2014) - Youth 2 Business Forum, Youth 2 Social Enterprise
- Youth Leadership Development (2010)
- Youth & Payahita Conference in 2015
- Winning Lecturer of Top Paper Prize
- Winners in TBE, SHRM and SMM Subjects

## **Past Career Life**

- Consultant to JICA Project at Ministry of Commerce, Retail Consultant (Big C Supermarket & Reuri Meiko Mart)
- Consultant cum Admin Director (APEI)
- Consultant (MWD Entertainment KMD & Apache Cement)
- Marketing Manager – MSIM,
- Chief Operating Officer of Blazon (Mandalay)
- Operation Manager and Wholesales Manager of Blazon (Yangon)
- Supermarket Food Section
- Human Resource Manager Giordano
- Marketing Assistant (Canon\_Myanmar)
- Data Collector (MSR)





## Info Myanmar University



**Prof Dr. San San Mon**  
**Advisory Board Member**

### Personal Details

Address	: 10/22, Hlaing Myintmo Housing, HlaingTownship, Yangon.
Contact Phone	: +95-01-512119
Email	: sansanmon@ucsm.edu.mmm
Date of Birth	: 10 February 1958

### Educations and Qualifications

Title	: B.Sc.(Maths)
Awarding Organisation	: University of Yangon
Duration	: 1979
Title	: M.Sc (Maths)
Awarding Organisation	: University of Yangon
Duration	: 1982
Title	: D.C.Sc.
Awarding Organisation	: University of Yangon ( ICST)
Duration	: 1995
Title	: Ph.D. (Engg: Maths)
Awarding Organisation	: Yangon Technology University
Duration	: 1982



## Industrial and Commercial Experiences

Name of Organisation	: University of Yangon
Position	: Assistant Lecturer
Duration	:1989- 1993
Name of Organisation	: University of Yangon ( Hlaing Campus)
Position	: Lecturer
Duration	: 1993 - 1995
Name of Organisation	: Magwe University
Position	: Lecturer
Duration	: 1996 - 1999
Name of Organisation	: University of Computer Studies, Mandalay
Position	: Lecturer
Duration	: 1999 - 2004
Name of Organisation	: University of Computer Studies, Mandalay
Position	: Associative Professor
Duration	: 2004 – 2015
Name of Organisation	: University of Computer Studies, Mandalay
Position	: Professor
Duration	: 2015 – 2018
Name of Organisation	: University of Computer Studies, Mandalay
Position	: Visiting Professor
Duration	: 2018 – 2019

## Teaching Experiences

Position	Lecturer at University of Yangon
Modules	1.Reference Lecturer 2.Information Seeking-Behaviour
Level	Post Graduate Diploma and Master Course
Position	Lecturer/ Associative Professor/Professor at UCSM
Modules	1. Management 2. Subject Headings 3. Drawing the curriculum and syllabus for Mathematics. 4. Supervise for Master of Computer Science/Technology. 5. Preparing Math study material for textbook
Level	Graduate / Post Graduate / Master/ Ph.D.(IT)

## Membership of Professional bodies/institutions

ရန်ကုန်တက္ကသိုလ်သချ်အသင်း





## Info Myanmar University



### **Prof Dr. Myat Thanda Khin**

### **Advisory Board Member**

#### **Personal Details**

Address	: No.(3), Building (6), (106) Hostel, Mingalardon, Yangon
Contact Phone	: +95-01-512119
Email	: drmyatthandarkhin@infomyanmarcollege.com
Date of Birth	: 10.5.1979

#### **Educations and Qualifications**

Title	: Ph.D (IT)
Awarding Organisation	: UCSY
Duration	: 2004-2007
Title	: M.C.Tech
Awarding Organisation	: UCSM
Duration	: 2001-2002
Title	: B.C.Tech (Hons:)
Awarding Organisation	: UCSM
Duration	: 2000-2001
Title	: B.C.Tech
Awarding Organisation	: UCSM
Duration	: 1997-2000



## Industrial and Commercial Experience

Name of Organisation	: Info Myanmar College
Position	: Professor
Duration	: 15.3.2018
Name of Organisation	: UCSY
Position	: Professor
Duration	: 23.3.2016
Name of Organisation	: UCSY
Position	: Associate Professor
Duration	: 14.3.2014
Name of Organisation	: UCS (Lashio)
Position	: Lecturer
Duration	: 15.10.2008
Name of Organisation	: UCS (Magway)
Position	: Assistant Lecturer
Duration	: 14.10.2005
Name of Organisation	: UCS (Magway)
Position	: Tutor
Duration	: 29.10.2001

## Teaching Experience

Position	: Professor at IMC
Modules	: Computer System, Networked Service
Level	: B.Sc (Computing) awarded by Edinburgh Napier University
Position	: Professor at IMC
Modules	: Routing Concepts : Networking Technologies, : Computer Systems Architecture : Information and Communication Technology
Level	: Level(4), HND, Pearson Education
Position	: Lecturer at Computer Universities
Modules	: Digital Fundamental : CS& Architecture : DSP : Data Communication,
Level	: 1 <sup>st</sup> Year to Master





Published Papers	
Title	: Performance Evaluation of Parallel Network Simulation
Year	: ICCA 2006 - Feb
Title	: Read and Write Integration File Service Workflow for Distributed File System Consistency Protocol
Year	: ICCA 2006 - Feb
Title	: Shortest Path Algorithm for Simple Network Simulations
Year	: ICCA 2007 - Feb



**Info Myanmar University (IMU)**

ဘာသာရပ်အလိုက် သင်ကြားမည့်  
ပုဂ္ဂလိက ကျောင်းဆရာ၊ဆရာမများ၏  
ဘွဲ့လက်မှတ်၊ အထောက်အထားများ၊  
သင်ကြားရေး အတွေ့အကြုံများ နှင့်  
ကိုယ်ရေးအကျဉ်း





## Info Myanmar University



**Prof Dr. May Thu Aung**

**Head of Academic**

### Personal Details

Address	: No.(016/B) Sat Yone Street, Yangon, Myanmar
Contact Phone	: +95-01-512119
Email	: drmaythuaung@imcscompany.com
Date of Birth	: 16/02/1978

### Educations and Qualifications

Title	:Ph.D (IT)
Awarding Organisation	:University of Computer Studies, Yangon
Duration	: 2005-2009
Title	:M.C.Sc
Awarding Organisation	:University of Computer Studies, Yangon
Duration	: 2002-2004
Title	:B.C.Sc
Awarding Organisation	:University of Computer Studies, Yangon
Duration	: 1996-2002

### Industrial and Commercial Experiences

Name of Organisation	Info Myanmar College
Position	Head of Academic
Duration	2018~Current
Name of Organisation	University of Computer Studies (Maubin), Myanmar
Position	Professor
Duration	2017-2018
Name of Organisation	University of Information Technology (UIT), Yangon, Myanmar
Position	Lecturer, Associate Professor
Duration	2015-2017



Name of Organisation	Institute of Communication and Technology Training Institute (ICTTI-JICA), Yangon, Myanmar
Position	Lecturer, Software Engineer
Duration	2008-2015
Name of Organisation	University of Computer Studies, Yangon, Myanmar
Position	Tutor, Assistant Lecturer
Duration	2002-2008

### Teaching Experiences

Position	Professor at Info Myanmar College
Modules	Scripting for Cybersecurity and Network, Business Skill of E-commerce, Project Development Implementation and Design, Employability Professional Development, Java Programming
Level	Higher National Diploma (HND), BSc Computing
Position	Professor at University of Computer Studies (Maubin), Myanmar
Modules	Management Information System, Java Programming
Level	Software Courses (2 <sup>nd</sup> year, 4 <sup>th</sup> year)
Position	Lecturer, Associate Professor at University of Information Technology (UIT), Yangon, Myanmar
Modules	Database Management System, Database Administration with Oracle, Data Processing Technique, Software Engineering, Data warehousing and Machine learning
Level	Software Courses (3 <sup>rd</sup> year, 4 <sup>th</sup> year, Ph.D courses)
Position	Lecturer at Institute of Communication and Technology Training Institute (ICTTI-JICA), Yangon, Myanmar
Modules	Project Management Course, Java programming framework, Advanced Java Spring framework, Software model and methodology, Database design and Administration
Level	Software development courses, Software Engineer or Network Engineer
Position	Tutor, Assistant Lecturer at University of Computer Studies, Yangon, Myanmar
Modules	Information Communication and Technology, C++ Programming
Level	Software Courses (1 <sup>st</sup> year, 2 <sup>nd</sup> year)

### Membership of Professional bodies/institutions

1: Member of Myanmar Computer Federation (MCF)

2: Member of JICA Alumni Association of Myanmar (JAAM)

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA), YANGON





Published Papers	
Title	Guessing, model checking and theorem proving of state machine properties – a case study on qlock
Conference	International Journal of Software Engineering and Computer Systems (IJSECS) ISSN: 2289-8522, Volume 4 Issue 2, pp. 1-18, August 2018 @University Malaysia Pahang, Malaysia
Year	2018
Title	Analysis of Two Flawed Versions of a Mutual Exclusion Protocol with Maude and SMAG
Conference	ICSCA 2018 UMP, Kuantan.
Year	@2017ACM, Malaysia 2018
Title	Guessing properties of the Qlock mutual exclusion protocol based on its graphical animations and confirming the properties by model checking
Conference	ICSA 2018 UMP, Kuantan. @2017 ACM, Malaysia
Year	2018
Title	Multidimensional Analysis for Census Data by Applying Star Schema Model
Conference	ICAIT2017, Myanmar
Year	2017
Title	Development of Mobile Learning in University of Information Technology
Conference	ACU, Korea
Year	2016



## Info Myanmar University



**Prof Dr. Tin Tin Aye**

**Registrar**

### Personal Details

Address	: Building 41, 4 (A), Pay (50) Street, Hledan, Kamayut Township, Yangon.
Contact Phone	: +95-01-512119
Email	: dr.tintinaye@infomyanmarcollege.com
Date of Birth	: 28.5.1958

### Educations and Qualifications

Title	: Ph.D (Engg:Physics)
Awarding Organisation	: Yangon Technological University
Duration	: 2000 - 2003
Title	: M.Sc (Physics)
Awarding Organisation	: Mandalay University
Duration	: 1982 – 1984
Title	: B.Sc (Physics)
Awarding Organisation	: Mandalay University
Duration	: 1976 - 1979
Title	: Youth Leadership & Development
Awarding Organisation	: Technological University (Kyaukse)
Duration	: 2018
Title	: Leadership & Professional Development
Awarding Organisation	: Technological University (Kyaukse)
Duration	: 2018



Title	: The Workshop on “CURRICULUM DESIGN FOR ENGINEERING DEGREE”
Awarding Organisation	: Technological University (Kyaukse)
Duration	: 2018
Title	: Human Resource and Development Department
Awarding Organisation	: Technological University (Kyaukse)
Duration	: 2017
Title	: Curriculum Development Workshop
Awarding Organisation	: Technological University (Kyaukse)
Duration	: 2017
Title	: Executive Quality Management Systems Training Program TIER I in Engineering Education
Awarding Organisation	: Mandalay Technological University
Duration	: 2014
Title	: Special Teacher Training (Batch 3)
Awarding Organisation	: Mandalay University
Duration	: 1994
Title	: Staff Skills Development Training (Batch 99)
Awarding Organisation	: Central Staff University, Phaung Gyi
Duration	: 1988

### Industrial and Commercial Experiences

Name of Organisation	: Info Myanmar College
Position	: Registrar
Duration	: Dec 2018 - Present
Name of Organisation	: Technological University (Kyaukse)
Position	: Professor
Duration	: 7.4.2016 – 27.9.2018
Name of Organisation	: Mandalay Technological University
Position	: Professor
Duration	: 24.3.2015 – 6.4.2018
Name of Organisation	: Mandalay Technological University
Position	: Associate Professor
Duration	: 16.1.2008 – 23.3.2015
Name of Organisation	: Department of Advanced Science & Technology (Mandalay)
Position	: Deputy Director
Duration	: 3.2.2007 – 15.1.2008
Name of Organisation	: Department of Biotechnology (Naypyitaw)
Position	: Deputy Director
Duration	: 1.1.2007 – 2.2.2007





Name of Organisation	: Department of Technology Promotion & Coordination (Yangon)
Position	: Deputy Director
Duration	: 9.12.2005 - 31.12.2006
Name of Organisation	: Department of Technology Promotion & Coordination (Yangon)
Position	: Lecturer
Duration	: 1.5.2004 - 8.12.2005
Name of Organisation	: Department of Engineering Physics, Pyay Technological University
Position	: Lecturer
Duration	: 1.4.2004 – 30.4.2004
Name of Organisation	: Department of Engineering Physics, Yangon Technological University
Position	: Assistant Lecturer
Duration	: 26.9.1996 – 31.3.2004
Name of Organisation	: Department of Physics, Yangon University _Regional College(3)
Position	: Assistant Lecturer
Duration	: 1.2.1996 – 25.9.1996
Name of Organisation	: Department of Physics, Yangon University
Position	: Assistant Lecturer
Duration	: 1.1.1996 – 31.1.1996
Name of Organisation	: Department of Physics, Mandalay University
Position	: Assistant Lecturer
Duration	: 5.8.1994 – 31.12.1995
Name of Organisation	: Department of Physics, Mandalay University
Position	: Demonstrator
Duration	: 2.10.1989 – 4.8.1994
Name of Organisation	: Department of Physics, Yaynanchaung College
Position	: Demonstrator
Duration	: 14.1.1987 – 30.9.1989
Name of Organisation	: B.E.H.S (1), Kyauk Se
Position	: SAT
Duration	: 7.1.1986 – 13.1.1987



Teaching Experience	
Position Modules Level	: Professor at Mandalay Technological University : Engineering Physics : 1 <sup>st</sup> Year Bachelor of Engineering
Position Modules Level	: Lecturer at Department of Engineering Physics, Yangon Technological University : Engineering Physics : 1 <sup>st</sup> Year, 2 <sup>nd</sup> Year Bachelor of Engineering
Position Modules Level	: Assistant Lecturer at Department of Physics, Yangon University _Regional College(3) : Physics : 2 <sup>nd</sup> Year, 3 <sup>rd</sup> Year Bachelor of Science
Position Modules Level	: Assistant Lecturer at Department of Physics, Mandalay University : Physics : 1 <sup>st</sup> Year, 2 <sup>nd</sup> Year, 3 <sup>rd</sup> Year, 4 <sup>th</sup> Year Bachelor of Science
Position Modules Level	: Demonstrator at Department of Physics, Yaynanchaung College : Physics : 1 <sup>st</sup> Year, 2 <sup>nd</sup> Year Bachelor of Science
Position Modules Level	: SAT at B.E.H.S (1), Kyauk Se : Physics : 9 <sup>th</sup> & 10 <sup>th</sup> Standard of Matriculation Exam



## Info Myanmar University



**Prof Dr. San San Mon**

**Head of Mathematics  
Department**

### Personal Details

Address	: 10/22, Hlaing Myintmo Housing, HlaingTownship, Yangon.
Contact Phone	: +95-01-512119
Email	: sansanmon@ucsm.edu.mmm
Date of Birth	: 10 February 1958

### Educations and Qualifications

Title	: B.Sc.(Maths)
Awarding Organisation	: University of Yangon
Duration	: 1979
Title	: M.Sc (Maths)
Awarding Organisation	: University of Yangon
Duration	: 1982
Title	: D.C.Sc.
Awarding Organisation	: University of Yangon ( ICST)
Duration	: 1995
Title	: Ph.D. (Engg: Maths)
Awarding Organisation	: Yangon Technology University
Duration	: 1982





## Industrial and Commercial Experiences

Name of Organisation	: University of Yangon
Position	: Assistant Lecturer
Duration	:1989- 1993
Name of Organisation	: University of Yangon ( Hlaing Campus)
Position	: Lecturer
Duration	: 1993 - 1995
Name of Organisation	: Magwe University
Position	: Lecturer
Duration	: 1996 - 1999
Name of Organisation	: University of Computer Studies, Mandalay
Position	: Lecturer
Duration	: 1999 - 2004
Name of Organisation	: University of Computer Studies, Mandalay
Position	: Associative Professor
Duration	: 2004 – 2015
Name of Organisation	: University of Computer Studies, Mandalay
Position	: Professor
Duration	: 2015 – 2018
Name of Organisation	: University of Computer Studies, Mandalay
Position	: Visiting Professor
Duration	: 2018 – 2019

## Teaching Experiences

Position	Lecturer at University of Yangon
Modules	1.Reference Lecturer 2.Information Seeking-Behaviour
Level	Post Graduate Diploma and Master Course
Position	Lecturer/ Associative Professor/Professor at UCSM
Modules	1. Management 2. Subject Headings 3. Drawing the curriculum and syllabus for Mathematics. 4. Supervise for Master of Computer Science/Technology. 5. Preparing Math study material for textbook
Level	Graduate / Post Graduate / Master/ Ph.D.(IT)

## Membership of Professional bodies/institutions

ရန်ကုန်တက္ကသိုလ်သချ်အသင်း



## Info Myanmar University



**Prof Dr. Aye Aye Myint**

**Program Director**

### Personal Details

Address	: No 180, 29 Qtr, Aung Tagon 4 <sup>th</sup> st, North Dagon Township
Contact Phone	: +95-01-512119
Email	: ayeayemyint1073@gmail.com
Date of Birth	: 21/10/1973

### Educations and Qualifications

Title	:Ph.D(IT)
Awarding Organisation	:University of Computer StudiesYangon(UCSY)
Duration	:2004 -2007
Title	:M.I.Sc (Credit)
Awarding Organisation	: University of Computer Studies Yangon(UCSY)
Duration	:2002 -2003
Title	:B.Sc (IC)
Awarding Organisation	:Yangon University
Duration	:1993
Title	: Professional Diploma in Java Programming
Awarding Organisation	:IMCEITS
Duration	:2010
Title	:D.C.Sc
Awarding Organisation	: University of Computer Studies Yangon(UCSY)
Duration	:1997-98



## Industrial and Commercial Experience

Name of Organisation	Info Myanmar College
Position	Professor
Duration	1/11/2017 –up to present
Name of Organisation	IMCEITS
Position	Professor
Duration	15/12/2010 - 31/10/2017
Name of Organisation	CU(Myitkyina)
Position	Lecturer(Principal)
Duration	1/4/2008 - 14/12/2017
Name of Organisation	CU(Mandalay)
Position	Assistant Lecturer
Duration	1/1/2008-31/3/2008
Name of Organisation	CU(Monywa)
Position	Assistant Lecturer
Duration	2003-2004
Name of Organisation	CU(Myitkyina)
Position	Tutor
Duration	2001-2003

## Teaching Experience

Position	Professor at Info Myanmar College
Modules	OOP,Java, SAD,Professional Practice,php,python,Database Design
Level	HND (Pearson Education) , B.Sc (Computing)
Position	Professor at IMCEITS
Modules	Web Technologies, J2SE, J2EE,Oracle Database,Software Engineering
Level	Post Graduates in IT including Ph.D, ME, MCSc, MCTech, BCSc, BCTech, BE(IT), BTech(IT)
Position	Lecturer(Principal) at Computer University (Myitkyina)
Modules	Administration , Unified Modeling Language
Level	Bachelor and Honors in IT
Position	Assistant Lecturer at Computer University(Mandalay)
Modules	Data Mining
Level	Master IT
Position	Assistant Lecturer at Computer University (Monywa)
Modules	Software Engineering
Level	Bachelor IT
Position	Tutor at Computer University (Myitkyina)
Modules	Introduction to Computer System
Level	Bachelor IT





Published Papers	
Title	: Aye Aye Myint, NiLar Thein, “Automatic Data Record Extraction from Business Web Pages and Assigning Labels to Record Fields”, In Proceeding of the Fifth International Conference on Computer Applications, p279-p285, Myanmar ICCA.
Year	: February 8-9, 2007
Title	: Aye Aye Myint, Myo Myo Naing, “A Study of Automatic Wrappers for Information Extraction”, In Proceeding of the Fourth International Conference on Computer Applications, p461-p468, Myanmar, ICCA.
Year	: February 23-24, 2006.



## Info Myanmar University



**Prof Dr. Myat Thanda Khin**  
**Program Manager**  
**(Master Programme)**

### Personal Details

Address	: No.(3), Building (6), (106) Hostel, Mingalardon, Yangon
Contact Phone	: +95-01-512119
Email	: drmyatthandarkhin@infomyanmarcollege.com
Date of Birth	: 10.5.1979

### Educations and Qualifications

Title	: Ph.D (IT)
Awarding Organisation	: UCSY
Duration	: 2004-2007
Title	: M.C.Tech
Awarding Organisation	: UCSM
Duration	: 2001-2002
Title	: B.C.Tech (Hons:)
Awarding Organisation	: UCSM
Duration	: 2000-2001
Title	: B.C.Tech
Awarding Organisation	: UCSM
Duration	: 1997-2000



### Industrial and Commercial Experience

Name of Organisation	: Info Myanmar College
Position	: Professor
Duration	: 15.3.2018
Name of Organisation	: UCSY
Position	: Professor
Duration	: 23.3.2016
Name of Organisation	: UCSY
Position	: Associate Professor
Duration	: 14.3.2014
Name of Organisation	: UCS (Lashio)
Position	: Lecturer
Duration	: 15.10.2008
Name of Organisation	: UCS (Magway)
Position	: Assistant Lecturer
Duration	: 14.10.2005
Name of Organisation	: UCS (Magway)
Position	: Tutor
Duration	: 29.10.2001

### Teaching Experience

Position	: Professor at IMC
Modules	: Computer System, Networked Service
Level	: B.Sc (Computing) awarded by Edinburgh Napier University
Position	: Professor at IMC
Modules	: Routing Concepts : Networking Technologies, : Computer Systems Architecture : Information and Communication Technology
Level	: Level(4), HND, Pearson Education
Position	: Lecturer at Computer Universities
Modules	: Digital Fundamental : CS& Architecture : DSP : Data Communication,
Level	: 1 <sup>st</sup> Year to Master





Published Papers	
Title	: Performance Evaluation of Parallel Network Simulation
Year	: ICCA 2006 - Feb
Title	: Read and Write Integration File Service Workflow for Distributed File System Consistency Protocol
Year	: ICCA 2006 - Feb
Title	: Shortest Path Algorithm for Simple Network Simulations
Year	: ICCA 2007 - Feb



## Info Myanmar University



**Dr. Ngu Wah Win**

**Program Manager  
(B.Sc(Hons)Programme)**

### Personal Details

Address	: No(2), Yuzana Street, 7-East Block, Tharkayta, Yangon
Contact Phone	: +95 – 01 - 512119
Email	: dr-nguwahwin@infomyanmarcollege.com
Date of Birth	: 31.8.1987

### Educations and Qualifications

Title	: Ph.D(IT) (Doctor of Philosophy (Information Technology))
Awarding Organisation	: University of Computer Studies, Yangon (UCSY)
Duration	: 2011 May to 2016 February
Title	: M.C.Tech (Master of Computer Technology)
Awarding Organisation	: University of Computer Studies, Yangon (UCSY)
Duration	: 2008 February to 2010 February
Title	: B.C.Tech (Hons) (Bachelor of Computer Technology (Honors))
Awarding Organisation	: University of Computer Studies, Yangon (UCSY)
Duration	: 2008 February
Title	: B.C.Tech (Bachelor of Computer Technology)
Awarding Organisation	: University of Computer Studies, Yangon (UCSY)
Duration	: 2007 February
Title	: Best Paper Award
Awarding Organisation	: International Journal of Computer Science and Information Security (IJCSIS-US, 2015)
Duration	:
Title	: Best Paper Award
Awarding Organisation	: International Conference on Computer Application (ICCA-2016)
Duration	:



### Industrial and Commercial Experiences

Name of Organisation	Info Myanmar College
Position	Lecturer
Duration	16.8.2017
Name of Organisation	University of Computer Studies, Kyaing Tong
Position	Tutor
Duration	15.8.2008

### Teaching Experiences

Position	Lecturer at Info Myanmar College (IMC)
Modules	Unit 25: Routing Concepts (Third Semester)
Level	Second Year
Position	Lecturer at Info Myanmar College (IMC)
Modules	Unit 24: Networking Technologies (First Semester)
Level	First Year
Position	Lecturer at Info Myanmar College (IMC)
Modules	Unit 2: Networking (First Semester)
Level	First Year
Position	Lecturer at Info Myanmar College (IMC)
Modules	Unit 27: Network Operating System
Level	First Year
Position	Tutor at University of Computer Studies, Kyaing Tong (UCSKTG)
Modules	Electronic Devices (Third Year) Engineering Circuit (Third Year) Digital Fundamental (First Year) Computer Networking (Fourth Year) Computer Architecture and Design (Fifth Year) 8085 Microprocessor (Fifth Year) Embedded System (Fourth Year) Data Communication (Third Year)
Level	First Year, Third Year, Fourth Year, Final





Published Papers	
Title Year	: Audio File Encryption by using AES and RSA Alorithm : 2009
Title Year	: Mobile Cloud Platform for Big Data Analytic : 2014
Title Year	: Improving Processing Time of Big Data Analytic on Mobile Cloud Computing : 2015
Title Year	: An Efficient Big Data Analytics Platform for Mobile Computing : 2015
Title Year	: Deploying Big Data Analytics on Mobile Cloud Environment : 2016



## Info Myanmar University



**Dr. Nu War Hsan**

**Program Manager  
(HND Programme)**

### Personal Details

Address	: 65 A Yadana Street, Yangon
Contact Phone	: +95-01-512119
Email	: nuwarhsan87@gmail.com
Date of Birth	: 07-08-1987

### Educations and Qualifications

Title	:Ph.D(IT)
Awarding Organisation	: Ministry of Education
Duration	:2015
Title	:M.C.Sc
Awarding Organisation	: Ministry of Education
Duration	:2009
Title	:B.C.Sc(Hons)
Awarding Organisation	: Ministry of Education
Duration	:2007
Title	:B.C.Sc
Awarding Organisation	:Ministry of Education
Duration	:2006



### Industrial and Commercial Experience

Name of Organisation	:Info Myanmar College
Position	:Lecturer
Duration	:22.9.2017-Present
Name of Organisation	:University of Computer Studies(Hinthada)
Position	:Tutor
Duration	:2008(August)-2017(August)

### Teaching Experience

Position	: Lecturer at Info Myanmar College :22-7-2017-Present
Modules	: Project Design Implementation and Evaluation, Web Applications Development, Employability and Professional Development, Professional Practice Business Skills for E-Commerce Information System in Organizations Python Programming Group Project
Level	: HND.B.C.Sc
Position	:Tutor at University of Computer Studies(Hinthada) 2008(August)-2017(August)
Modules	:Web Design, Web Development, Management Information System, E-Commerce Project Management, Database Management System, System Analysis and Design
Level	First Year, Second Year, Third Year, Hons, Master

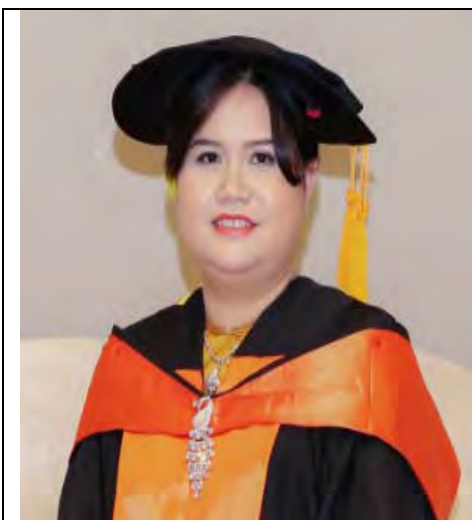




Published Papers	
Title	Nu War Hsan, “Developing Web based Agents for Prediction System”, Parallel Software Computing (PSC), University of Computer Studies, Yangon
Year	2009
Title	Nu War Hsan, “ <b>Automatic Recommendation in Adaptive Educational System based on Web Usage Mining</b> ”, In proceeding of the 1 <sup>st</sup> International Conference on Energy, Environment and Human Engineering Organized by Nagaoka of Technology (NUT), Nihon University (NU), Saitama University (SU), Association of Japan Myanmar Mutual Cooperation (AJMCC) and Myanmar Maritime University (MMU)
Year	December 2013
Title	Nu War Hsan “ <b>Extracting User’s Interests from Web Log Data for Implementing Adaptive Education System</b> ”, in proceeding of the 12 <sup>th</sup> International Conference on Computer Application
Year	February 2014
Title	Nu War Hsan, “ <b>Semantic Web Usage Mining to Develop Prediction System</b> ”, in proceeding of International Journal of Computer Applications (JICA), New York
Year	December, USA, 2014
Title	Nu War Hsan, “ <b>Implementing Prediction System by Using Ontology based PHS Algorithm</b> ”, in proceeding of the 12 <sup>th</sup> International Conference on Computer Application
Year	February 2015
Title	Nu War Hsan, “ <b>Developing Prediction System by Using Ontology based PHS Algorithm</b> ” in proceeding of the ILER International Conference on Science, Technology, Engineering and Management, Singapore
Year	February, 2015
Title	Nu War Hsan, “ <b>Developing Prediction System by Using Ontology based PHS Algorithm</b> ” in proceeding of the International Journal of Advances in Electronics and Computer Science, JIAECS, Volume2, Issue 6,
Year	June,2015



## Info Myanmar University



**Dr. Ingyin Khaing**

**Program Manager  
(Pre-HND Programme)**

### Personal Details

Address	: No (24 (D) 5B Nar Nat Taw Street, (8) Yard, Kamaryut Township, Yangon, Myanmar.
Contact Phone	: +95-01-512119
Email	: ingyinkhaing@gmail.com
Date of Birth	: 11.8.1985

### Educations and Qualifications

Title	: PhD(IT)
Awarding Organisation	: University of Technology (Yadanapon Cyber City)
Duration	: 2014
Title	: M.C. Tech
Awarding Organisation	: University of Computer Studies (Yangon)
Duration	: 2009
Title	: B.C. Tech (Hons.)
Awarding Organisation	: University of Computer Studies (Yangon)
Duration	: 2005
Title	: B.C. Tech
Awarding Organisation	: University of Computer Studies (Yangon)
Duration	: 2004



### Industrial and Commercial Experiences

Name of Organisation	Info Myanmar College
Position	Lecturer
Duration	29.8.17 to now
Name of Organisation	University of Computer Studies (Maubin)
Position	Tutor
Duration	2.5.2009 to 31.6.2017
Name of Organisation	University of Computer Studies (Dawei)
Position	Tutor
Duration	15.2.2007 to 30.4.2009

### Teaching Experiences

Position	Lecturer at Info Myanmar College
Modules	Computer Systems Architecture, Networking Technology, Internet Server Management, Networking, Routing Concepts
Level	HND (Level 5), HNC (Level 4)
Position	Tutor at University of Computer Studies (Dawei)
Modules	Fundamentals of Digital, Computer Architecture, Electronic Devices
Level	Bachelor, Hons.
Position	Tutor at University of Computer Studies (Maubin)
Modules	Fundamentals of Digital, Computer Architecture, Electronic Devices, Cryptography, Data communications
Level	Bachelor, Hons.
Position	Tutor at University of Technology (Yadanapon Cyber City)
Modules	Digital Image Processing
Level	Bachelor





Published Papers	
Title	: Myanmar Continuous Speech Recognition System Based on DTW and HMM
Year	: 2013
Title	: A Speech Recognition System for Myanmar Language
Year	: 2013
Title	: Automatic Speech Recognition System for Continuous Myanmar Language Using HMM
Year	: 2013
Title	: Design and Implementation of Speech Recognition System for Myanmar Language
Year	: 2014
Title	: Automatic Speech Segmentation for Myanmar Language
Year	: 2014
Title	: An Arrhythmia Classification System Based On the RR-Interval Signal
Year	: 2009



## Info Myanmar University



**Dr. Aye Mya Thandar**

**Research & Development  
Programme Leader**

### Personal Details

Address	: 4 <sup>th</sup> floor, (7/k),(Sa/Ka), Thamardi 2 <sup>nd</sup> Rd, Thingangyun, Yangon, Myanmar
Contact Phone	: +95-01-512119
Email	: <a href="mailto:ayemyathandar7@gmail.com">ayemyathandar7@gmail.com</a>
Date of Birth	: 5.5.1984

### Educations and Qualifications

Title	: Doctor of Philosophy in Information Technology Ph.D(IT)
Awarding Organisation	: University of Computer Studies, Yangon
Duration	: Completed in 2013
Title	: Master of Computer Science-M.C.Sc
Awarding Organisation	: University of Computer Studies, Yangon
Duration	: Completed in 2008
Title	: Bachelor of Computer Science – B.C.Sc(Hons)
Awarding Organisation	: University of Computer Studies, Sittway
Duration	: Completed in 2005
Title	: Bachelor of Computer Science – B.C.Sc
Awarding Organisation	: University of Computer Studies, Sittway
Duration	: Completed in 2003



Title	: SOI ASIA Online Course Certificate
Awarding Organisation	: Keio University, Japan
Duration	: Completed in 2009
Title	:Python 3 Online Course Completed Certificate
Awarding Organisation	:SOLOLEARN Online Learning Center
Duration	:Completed 2019
Title	:SQL Online Course Completed Certificate
Awarding Organisation	: SOLOLEARN Online Learning Center
Duration	:Completed 2019

### Industrial and Commercial Experience

Name of Organisation	Info Myanmar College
Position	Lecturer
Duration	2017 October to Present
Name of Organisation	University of Computer Studies, Pakokku
Position	Assistant Lecturer
Duration	2016 -2017 September
Name of Organisation	University of Computer Studies, Patheingyi
Position	Assistant Lecturer
Duration	2014-2016
Name of Organisation	University of Computer Studies, Yangon
Position	Tutor
Duration	2009-2014
Name of Organisation	University of Computer Studies, Patheingyi
Position	Tutor
Duration	2007-2009





Teaching Experience	
Position	Info Myanmar College
Modules	Business Skills for E-Commerce, Database Design and Development, Employability and Professional Development, Java Programming, Information Systems In Organizations, Successful Computing Project
Level	Higher National Diploma in Computing(QCF, RQF)
Position	University of Computer Studies, Pakokku
Modules	MySQL Database, Programming Languages, E- Business, Data Mining, Software Engineering
Level	From first year to final year
Position	University of Computer Studies, Patheingyi
Modules	HTML, Assembly Language Programming, Management Information System
Level	First year, Second year and Third year
Position	University of Computer Studies, Yangon
Modules	JavaScript, Application, VB.Net
Level	First year, Second year
Position	University of Computer Studies, Patheingyi
Modules	Assembly Language programming, OOP programming
Level	First year and Third Year



Published Papers	
Title	[p1] “Radial Basis Function (RBF) Neural Network Classification based on Consistency Evaluation Measure”, International Journal of Computer Applications 54(15):20-23, New USA. BibTeX;
Year	September (2012)
Title	[p2] “RBF neural network based on clonal selection algorithm for medical data diagnosis”, 10 <sup>th</sup>
Year	International Conference on Computer Applications, February 28-29(2012)
Title	[p3] “Artificial Neural Network Based on Genetic Algorithm for Medical data diagnosis”, 11 <sup>th</sup>
Year	International Conference on Computer Applications, (2013)
Title	[p4] “Hybrid learning of wrapper and embedded method for feature selection of medical data”, 9 <sup>th</sup>
Year	International Conference on Computer Applications, May 5-6(2011)
Title	[p5] “Decision Support For Breast Cancer Classification Using Bayesian Analysis”, 1 <sup>st</sup> Parallel and Software Computing Conference,
Year	December, (2007)
Title	[p6] “Scaling up the Naïve Bayesian Classifier using Genetic and Decision Tree for feature selection”, 5 <sup>th</sup>
Year	Parallel and Software Computing Conference, December, (2010)
Title	[p7] “Improved Clonal Selection-based RBF Neural Network Classifier for Feature Selection”, IEEE Life Science Grand Challenges Conference,
Year	Dec 2-3, Singapore (2013)
Title	[p8] “The Improved Artificial Neural Networks based on an immune algorithm for Medical data diagnosis”, 1 <sup>st</sup> International Conference on Energy, Environment and Human Engineering,
Year	Dec 22-23, Japan (2013)



## Info Myanmar University



**Daw Hnin Pwint Phyu**

**Internal Auditor,  
Academic Quality  
Assurance**

### Personal Details

Address	: No. 26, WaiBarGi Housing, North Okkala Twsp, Yangon.
Contact Phone	: 09256186585
Email	: snowpwintphyu21@gmail.com
Date of Birth	: 2 <sup>nd</sup> March, 1974

### Educations and Qualifications

Title	: <b>M.C.Tech</b>
Awarding Organisation	: University of Computer Studies, Yangon
Duration	: 1998 to 2002
Title	: <b>B.C.Tech</b>
Awarding Organisation	: University of Computer Studies, Yangon
Duration	: 1993 to 1998





### Industrial and Commercial Experiences

Name of Organisation	: Info Myanmar College
Position	: Lecturer
Duration	: 2016 - Present
Name of Organisation	: Myanmar Computer Professional Association
Position	: Lecturer
Duration	: 2010-2016
Name of Organisation	: University of Computer Studies
Position	: Assistant Lecturer
Duration	: 2005 - 2008
Name of Organisation	: University of Computer Studies
Position	: Tutor
Duration	: 1999- 2005

### Teaching Experiences

Position	IMC (Info Myanmar College)
Modules	Information and Communication Technology
Level	Pre HND
Position	IMC (Info Myanmar College)
Modules	Unit 8, Computer Systems Architecture
Level	Level 4 HNC, Pearson Education
Position	IMC (Info Myanmar College)
Modules	CSN08601 Computer Systems
Level	BSc (Computing), Edinburgh Napier University
Position	UCSM
Modules	Digital Fundamental, Data Communication
Level	2 <sup>nd</sup> Year and 3 <sup>rd</sup> Year
Position	UCSY
Modules	Digital Fundamental, Electrical Circuit, Electronic Device, Computer Architecture, TCP/IP
Level	2 <sup>nd</sup> Year, 3 <sup>rd</sup> Year, Hons and Master



## Info Myanmar University



**Dr. Nyo Nyo Htwe**

**Lecturer**

### Personal Details

Address	: No (6), 2B Kyun Chan Street, (4) Yard, Kamayut Township, Yangon, Myanmar.
Contact Phone	: +95-01-512119
Email	: nyonyohtwe1@gmail.com
Date of Birth	: 11.3.1986

### Educations and Qualifications

Title	: PhD(IT)
Awarding Organisation	: University of Technology (Yadanapon Cyber City)
Duration	: 2014
Title	: M.C. Tech
Awarding Organisation	: University of Computer Studies (Yangon)
Duration	: 2010
Title	: B.C. Tech (Hons.)
Awarding Organisation	: University of Computer Studies (Yangon)
Duration	: 2007
Title	: B.C. Tech
Awarding Organisation	: University of Computer Studies (Yangon)
Duration	: 2006



### Industrial and Commercial Experiences

Name of Organisation	Info Myanmar College
Position	Lecturer
Duration	May 2018 - Present
Name of Organisation	University of Computer Studies (Maubin)
Position	Assistant Lecturer
Duration	(Nov 2017 – May 2018)
Name of Organisation	University of Computer Studies (Myeik)
Position	Assistant Lecturer
Duration	(Nov 2014 - Oct 2017)
Name of Organisation	University of Computer Studies (Yangon)
Position	Tutor
Duration	(Feb 2007 - Dec 2009)

### Teaching Experiences

Position	Lecturer at Info Myanmar College
Modules	Information and Communication Technology (ICT), Computer Systems Architecture, Security, Network Security and Cryptography
Level	Pre HND, HNC (Level 4), ENU
Position	Assistant Lecturer at University of Computer Studies (Maubin)
Modules	Fundamentals of Digital, Computer Architecture, Digital Control System, Electronic Devices, Cryptography, Operating System
Level	Bachelor, Hons.
Position	Assistant Lecturer at University of Computer Studies (Myeik)
Modules	Fundamentals of Digital, Computer Architecture, Digital Control System, Cryptography, Digital Image Processing using Matlab
Level	Bachelor, Hons
Position	Assistant Lecturer at University of Technology (Yadanapon Cyber City)
Modules	Digital Image Processing using Matlab, Digital Control System
Level	Bachelor
Position	Tutor at University of Computer Studies Yangon
Modules	Fundamentals of Digital, Computer Architecture
Level	Bachelor, Hons.





Published Papers	
Title Year	: Gender Identification using Biometric Gait Features : 2014
Title Year	: Human Identification Using Biometric Gait Features : 2014
Title Year	: Human Identification Based Biometric Gait Features Using MSRC : 2013
Title Year	: Gender Classification Based Gait Features Using MSRC : 2013
Title Year	: Acoustic Echo Cancellation Using Normalised Least Mean Square (NLMS) : 2009



## Info Myanmar University



**Daw Nwe Nwe Oo**

**Business Development  
Manager**

### Personal Details

Address	: No. 4 A, Tayza Street, Pagosu Quarter, Thanlyin Township, Yangon. Myanmar.
Contact Phone	: +95-01-512119
Email	: <a href="mailto:nwenweoo@imcscompany.com">nwenweoo@imcscompany.com</a>
Date of Birth	: 14.05.1977

### Educations and Qualifications

Title	: M.Sc in Computer Science (Online)
Awarding Organisation	: University of Yangon
Duration	: 2018 ~ Present
Title	: B.Sc (Zoology)
Awarding Organisation	: University of Distance Education, Yangon
Duration	: June 1995- Oct 2000
Title	: Post Graduate Diploma in Strategic Business IT
Awarding Organisation	: NCC,UK
Duration	: Mar,2016
Title	: Post Graduate Diploma in Computer Application
Awarding Organisation	: University of Yangon
Duration	: Aug 2006 – Nov 2007
Title	: International Advanced Diploma in Computer Studies (IADCS)
Awarding Organisation	: NCC,UK
Duration	: Sept 2001-Sept 2002
Title	: International Diploma in Computer Studies(IDCS)
Awarding Organisation	: NCC,UK
Duration	: Dec 1996- Dec 1997



Title	: Global Leader for Innovation and Knowledge Programme
Awarding Organisation	: Japan America Institute of Management Science, Japan
Duration	: 21 Feb 2018 - 1 Jun 2018
Title	: Diploma in Human Resource Management
Awarding Organisation	: International Qualification Network, UK
Duration	: Feb 2017 – May 2017
Title	: Cert: in Basic Diplomatic Skills
Awarding Organisation	: MOFA, Myanmar
Duration	: 6 Jan 2016 – 25 Mar 2016
Title	: Cert: in Information Security Management System (ISO27000)
Awarding Organisation	: SGS, Thailand
Duration	: Jun 2011
Title	: Cert: in Quality Management System (ISO 9001:2008) Lead Auditor
Awarding Organisation	: UKAS
Duration	: Sep 2010
Title	: Certified in IT for IT Engineer
Awarding Organisation	: AOTS, Japan
Duration	: 11 Nov 2004 – 24 Dec 2004
Title	: Certified in Myanmar Network Systems Engineers
Awarding Organisation	: AOTS (Japan) and MCF
Duration	: 9 Feb 2004 – 20 Feb 2004
Title	: Certified in Multimedia System Development Course
Awarding Organisation	: CICC(Japan) and MCPA
Duration	: 23 Nov 2003- 18 Jan 2004
Title	: Certified in ICT Professional Training Course
Awarding Organisation	: MEMI(Japan) and MCF
Duration	: 14 Feb 2003-11 Apr 2003
Title	: Certified in Japan IT Engineering
Awarding Organisation	: AOTS(Japan) and MCF
Duration	: 8 Oct 2001- 26 Nov 2001

### Industrial and Commercial Experiences

Name of Organisation	: Info Myanmar College
Position	: General Manager
Duration	: Jan 2019 ~ Present
Name of Organisation	: Education Services, MCC
Position	: Chief Operating Officer
Duration	: Feb 2017 ~ Dec 2018
Name of Organisation	: Education Services, MCC
Position	: Director
Duration	: Feb 2013 ~ Jan 2017





Name of Organisation	: Education Services, MCC
Position	: Deputy Director
Duration	: Feb 2012 ~ Jan 2013
Name of Organisation	: Education Services, MCC
Position	: General Manager
Duration	: Feb 2009 ~ Jan 2012
Name of Organisation	: Education Services, MCC
Position	: Deputy General Manager
Duration	: Feb 2007 ~ Jan 2009
Name of Organisation	: Education Services, MCC
Position	: Assistant General Manager
Duration	: Jan 2005 ~ Jan 2007
Name of Organisation	: Education Services, MCC
Position	: Training Manager
Duration	: Jan 2003 ~ Dec 2004
Name of Organisation	: Education Services, MCC
Position	: Assistant Training Manager
Duration	: Jan 2002 ~ Dec 2002
Name of Organisation	: Education Services, MCC
Position	: Instructor
Duration	: May 98 ~ Dec 2001

### Teaching Experiences

Position	: Education Services, MCC
Modules	: Professional Issues in Information Technology
Level	: Level 5 Diploma in Computing, NCC Education, UK
Position	: Education Services, MCC
Modules	: Skills for Computing
Level	: Level 4 Diploma in Computing, NCC Education, UK
Position	: Education Services, MCC
Modules	: Business Communication
Level	: Level 4 Diploma in Computing, NCC Education, UK
Position	: Education Services, MCC
Modules	: Computer Systems
Level	: Level 4 Diploma in Computing, NCC Education, UK
Position	: Education Services, MCC
Modules	: Business Organisation, Multimedia, Systems Development
Level	: International Diploma in Computer Studies, NCC Education, UK

### Membership of Professional bodies/institutions

Professional Member, Myanmar Computer Professional Association (MCPA)



## Info Myanmar University



**Daw Khin Kyu**

**Librarian**

### Personal Details

Address	: No. 51, U Lun Mg (4) Lane, 7 Mile, & Quarter, Mayangone Township, Yangon.
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Email	: khinkyukyu.23@gmail.com
Date of Birth	: 23 April 1954

### Educations and Qualifications

Title	: M.A (Library & Information Studies)
Awarding Organisation	: University of Yangon
Duration	: 2001
Title	: M.Sc (Zoology)
Awarding Organisation	: University of Yangon
Duration	: 1981
Title	: Diploma (Library & Information Studies)
Awarding Organisation	: University of Yangon
Duration	: 1985
Title	: B.Sc (Zoology)
Awarding Organisation	: University of Yangon
Duration	: 1977



### Industrial and Commercial Experience

Name of Organisation	: University of Yangon
Position	: Lecturer
Duration	: 2001- 2014
Name of Organisation	: University of Yangon
Position	: Assistant Lecturer
Duration	: 1998 - 2001
Name of Organisation	: Institute of Economics
Position	: Librarian
Duration	: 1996 - 1998
Name of Organisation	: Sittwe Degree College
Position	: Librarian
Duration	: 1994 - 1996
Name of Organisation	: University of Yangon
Position	: Assistant Librarian
Duration	: 1987 – 1994
Name of Organisation	: Universities' Central Library
Position	: Assistant Librarian
Duration	: 1985 - 1987

### Teaching Experience

Position	Lecturer at University of Yangon
Modules	1.Reference Lecturer 2.Information Seeking-Behaviour
Level	Post Graduate Diploma and Master Course
Position	Assistant Lecturer
Modules	1. Management 2. Classification 3. Subject Headings 4. References 5. Cataloguing (လူစွမ်းအားအရင်းအမြစ်သင်တန်း)
Level	Post Graduate Diploma and Master Course

### Membership of Professional bodies/institutions

Myanmar Library Association (မြန်မာနိုင်ငံ စာကြည့်တိုက်အသင်း)






Published Papers	
Title	Abstracting & Indexing Services (NISIT, Hyderabad, India)
Year	9.10.1997
Title	New Treatment of Fast and Firm Building of DDC Numbers based on the 19 <sup>th</sup> and 20 <sup>th</sup> ed.
Year	-
Title	Technical Approach to Abstracting and Indexing of Myanmar Periodicals (စုံညီပွဲတော်စာတမ်းဖတ်ပွဲ၊ အပန်းဖြေရိပ်သာ)
Year	(31.1.2002)
Title	ရန်ကုန်တိုင်းကမာရွတ်မြို့နယ်ရှိ အခြေခံပညာအထက်တန်း ကျောင်းအချို့၏ စာကြည့်တိုက်များကိုလေ့လာခြင်း(စုံညီပွဲ တော်စာတမ်းဖတ်ပွဲ၊ စီးပွားရေးတက္ကသိုလ်)
Year	31.12.2004
Title	ရန်ကုန်မြို့တော်အတွင်းရှိ ပညာရေးဝန်ကြီးဌာနလက် အောက်ခံ တက္ကသိုလ်စာကြည့်တိုက်များ ၏ ဖွံ့ဖြိုးမှုကို လေ့လာခြင်း (ဝိဇ္ဇာ/သိပ္ပံပညာရှင်အဖွဲ့ ၅ကြိမ်မြောက် စာတမ်း ဖတ်ပွဲ၊ စီးပွားရေးတက္ကသိုလ်)
Year	25.10.2005
Title	Training Workshop on Managing the Integration of Culture into Development Programmes
Year	2005
Title	ရန်ကုန်စီးပွားရေးတက္ကသိုလ်စာကြည့်တိုက်ကို လေ့လာခြင်း (ဝိဇ္ဇာ/သိပ္ပံပညာရှင်အဖွဲ့ ၆ကြိမ်မြောက်စာတမ်းဖတ်ပွဲ။ ရန်ကုန်စီးပွားရေးတက္ကသိုလ်)
Year	27.11.2006
Title	တက္ကသိုလ်များ ဗဟိုစာကြည့်တိုက်ရှိ ပုရပိုက်များတွင်ပါဝင် သော ဆေးပညာဆိုင်ရာဖော်ပြချက်များကိုလေ့လာခြင်း (ဝိဇ္ဇာ/သိပ္ပံပညာရှင်အဖွဲ့ ၇ကြိမ်မြောက် စာတမ်းဖတ်ပွဲ)
Year	2007
Title	The Relationship between the Information Resources of Libraries and their Supports in Teaching (ရန်ကုန်တက္ကသိုလ် စာတမ်းဖတ်ပွဲအစီအစဉ်)
Year	17.10.2007
Title	Shelving Methods in Libraries (ရန်ကုန်တက္ကသိုလ် စာတမ်းဖတ်ပွဲအစီအစဉ်)
Year	-
Title	Studies on Some Traditional Medicine Found in Myanmar Manuscripts (ဝိဇ္ဇာ/သိပ္ပံပညာရှင်အဖွဲ့ ၈ကြိမ်မြောက် စာတမ်းဖတ်ပွဲ)
Year	2008
Title	Searching Some Information and Library



Year	Resources on the Internet (ရန်ကုန်တက္ကသိုလ်စာတမ်း ဖတ်ပွဲအစီအစဉ်) 19.11.2008
Title	Library Surveys (ရန်ကုန်တက္ကသိုလ်စာတမ်းဖတ်ပွဲအစီအစဉ်)
Year	13.5.2009
Title	Library Floor Plan: The Library of Congress
Year	Oct 2009
Title	Library Floor Plan: The National Diet Library (Japan)
Year	Feb.,2010
Title	ဒုတိယသမမျိုးတူစုစနစ်တွင် ချဲ့ထွင်ဖြည့်စွက်ပေးရန် လိုအပ်သော မြန်မာတိုင်းရင်းသားဆေးပညာရပ်ဆိုင်ရာမျိုးတူ အမှတ်များကို အဆိုပြု ခြင်း
Year	-
Title	Library Building: Singapore's New National Library
Year	Aug 2010
Title	Verbal Subject Analysis
Year	2011
Title	Study on Dewey Decimal Classification System
Year	July 2011
Title	University Undergraduate Student's Information Seeking Behaviour: Implications for Quality in Higher Education In Africa
Year	Nov,2011
Title	Information Seeking Models
Year	Aug,2012
Title	Information Needs and Information-Seeking Behaviour of Arts and Humanities Teachers,
Year	Nov,2012



## Info Myanmar University

	<p><b>Daw Yin Yin Min</b></p> <p><b>Assistant Registrar</b></p>
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Personal Details	
Address	: No. 1 , Thitsar Shin Street, KanlaySu Quarter, Mayangone Township, Yangon. Myanmar.
Contact Phone	: +95-01512119
Email	: yinyinmin.4517@gmail.com
Date of Birth	: 25.11.1978

Educations and Qualifications	
Title Awarding Organisation Duration	: M.I.Sc (Master of Information Science) : University of Computer Studies (Myeik) : 2007 - 2010
Title Awarding Organisation Duration	: B.Sc(Bachelor of Science_Maths) : Degree College : 2000 - 2003
Title Awarding Organisation Duration	: D.C.Sc(Diploma in Computer Science) : University of Computer Studies (Myeik) : 2005 - 2006
Title Awarding Organisation Duration	: Diploma in Human Resource Management : International Qualification Network, UK : Feb 2017 – May 2017





## Industrial and Commercial Experience

Name of Organisation	: Student Service, Info Myanmar College
Position	: Assistant Registrar
Duration	: Jan 2019 ~ Present
Name of Organisation	: Student Service, Info Myanmar College
Position	: Assessment Section Officer
Duration	: Jan 2018 ~ July 2018
Name of Organisation	: Student Service, Info Myanmar College
Position	: Manager
Duration	: April 2017 ~ Jan 2018
Name of Organisation	: Education Services, MCC
Position	: Deputy General Manager
Duration	: Feb 2016 ~ March 2017
Name of Organisation	: Education Services, MCC
Position	: Assistant General Manager
Duration	: Feb 2014 ~ Jan 2016
Name of Organisation	: Education Services, MCC
Position	: Lecturer
Duration	: April 2012 ~ Jan 2014
Name of Organisation	: Education Services, MCC
Position	: Assistant Lecturer
Duration	: August 2010 ~ March 2012

## Teaching Experiences

Position	: Assistant Registrar at Info Myanmar College
Modules	: Unit 3: Employability and Professional Development
Level	: QCF_ HND Diploma
Position	: Assistant Registrar at Info Myanmar College
Modules	: Unit 3: Professional Practice
Level	: RQF_ HND Diploma
Position	: Deputy General Manager at Education Services, MCC
Modules	: Database Design and Development
Level	: Level 5 Diploma in Computing, NCC Education, UK
Position	: Assistant General Manager at Education Services, MCC
Modules	: Agile Development
Level	: Level 5 Diploma in Computing, NCC Education, UK
Position	: Lecturer at Education Services, MCC
Modules	: Database
Level	: Level 4 Diploma in Computing, NCC Education, UK
Position	: Assistant Lecturer at Education Services, MCC
Modules	: System Design
Level	: International Diploma in Computer Studies, NCC Education, UK



Position	: Assistant Lecturer at Education Services, MCC
Modules	: Programming Methods
Level	: International Diploma in Computer Studies, NCC Education, UK

### **Membership of Professional bodies/institutions**

Member, Myanmar Computer Professional Association (MCPA)

### **Published Papers**

Title	: KNOWLEDGE-BASED SYSTEM FOR THE PRODUCTION OF SOFT-SHELLED MUD CRAB (Master Thesis, Computer University , Myeik)
Year	: 2009
Title	: KNOWLEDGE-BASED SYSTEM FOR THE PROCESS OF SOFT-SHELLED MUD CRAB (Paper ID -1025) Computer University, Myeik
Year	: 2009



## Info Myanmar University



**Daw Khin Win Le Phyu**

**Assistant Admin Manager**

### Personal Details

Address	: 7/10/39 Nawarat 7 Quarter, Shwe Yangon.
Contact Phone	: +95 – 01 - 512119
Email	: -
Date of Birth	: 1 May 1974

### Educations and Qualifications

Title	: B.Sc (Maths)
Awarding Organisation	: Taunggyi University
Duration	: 1995 - 2000
Title	: Diploma in Global English
Awarding Organisation	: University of Yangon
Duration	: 2004
Title	: Diploma in Computer Science
Awarding Organisation	: University of Yangon
Duration	: 2006





Industrial and Commercial Experience	
Name of Organisation	: Info Myanmar College
Position	: Assistant Admin Manager
Duration	: 2014 - Present
Name of Organisation	: Big John Co., Ltd
Position	: Manager
Duration	: 2007- 2012
Name of Organisation	: Supreme Co., Ltd
Position	: Supervisor
Duration	: 2004 - 2007
Name of Organisation	: Ministry of Science and Technology
Position	: Upper Clerk
Duration	: 2002 - 2004



## Info Myanmar University



**U Tun Aung**  
**Lecturer**

### Personal Details

Address	: No(60/70), Nguwar Street, Ahone Township, Yangon, Myanmar.
Contact Phone	: +95-01-512119
Email	: tacomputerster@gmail.com
Date of Birth	: 24.09.1960

### Educations and Qualifications

Title	:M.Sc. (Thesis) (Geology)
Awarding Organisation	:Yangon University
Duration	:1986-1991
Title	:B.Sc. (Hons:) (Geology)
Awarding Organisation	:Yangon University
Duration	:1984-1985
Title	:B.Sc. (Credit) (Geology)
Awarding Organisation	:Yangon University
Duration	:1982-1983
Title	: Diploma of Network Engineer
Awarding Organisation	:Human Resources Department
Duration	:2003
Title	: Diploma of Hardware Engineer
Awarding Organisation	:Human Resources Department
Duration	:2000-2002



### Industrial and Commercial Experiences

Name of Organisation	IMCS
Position	Lecturer
Duration	2015 to 2016
Name of Organisation	SAP Computer and Mobile Sales and Service
Position	Manager
Duration	2012-2014
Name of Organisation	TA Computer Sales, Service and Training Center
Position	Training Teacher and Manager
Duration	2002-2010
Name of Organisation	UNHCR
Position	Computer Department Head
Duration	1994-2002
Name of Organisation	CE Computer Sales & Service
Position	Hardware Engineer
Duration	1992-1994
Name of Organisation	University of Yangon ( Geology Department )
Position	Assistant Lecturer
Duration	1986 to 1992
Name of Organisation	Corporation of Myanmar GEM
Position	Gemmologist
Duration	1984 to 1985

### Teaching Experiences

Position	Lecturer at Info Myanmar College
Module	Computer System and Architecture
Level	HND Diploma, Pearson Education
Position	Manager at IMCS Training Center
Module	Hardware A+, Network N+
Level	Network Engineering Course
Position	Teacher at SAP Computer Training
Module	Computer Hardware and Networking
Level	Certificate Course
Position	Teacher at TA Computer Training
Module	Computer Hardware and Software
Level	Certificate Course





## Info Myanmar University



**Daw Thida Lwin**

**Lecturer**

### Personal Details

Address	: No. 202/8 Mahawgani Street ,25 Qtr Thuwunna Yangon
Contact Phone	: +95-01-512119
Email	: thidalwin31@gmail.com
Date of Birth	: 31.10.1971

### Educations and Qualifications

Title	:M.I.Sc
Awarding Organisation	:University of Computer Studies, Yangon
Duration	:1998
Title	:M.Sc (Maths.)(QII)
Awarding Organisation	:Yangon University
Duration	:1996
Title	:B.Sc (Maths.)
Awarding Organisation	:Yangon University
Duration	:1994
Title	:MCTS
Awarding Organisation	:Microsoft Certified Technology Specialist
Duration	:2008
Title	:.Net Framework 2.0 Web Application
Awarding Organisation	: Microsoft Certified Technology Specialist
Duration	:2008
Title	:Web Developer
Awarding Organisation	: Microsoft Certified Professional Developer
Duration	:2008



### Industrial and Commercial Experiences

Name of Organisation	Info Myanmar College
Position	Lecturer
Duration	4.12.2018
Name of Organisation	New Horizon
Position	Senior Lecturer
Duration	2018
Name of Organisation	UNL
Position	Senior Lecturer
Duration	2015-2018
Name of Organisation	University of Computer Studies, Maubin
Position	Assistant Lecturer
Duration	2007-2008
Name of Organisation	University of Computer Studies, Pinlon
Position	Assistant Lecturer
Duration	2005-2007
Name of Organisation	University of Computer Studies, Yangon
Position	Assistant Lecturer
Duration	2004-2005
Name of Organisation	University of Computer Studies, Yangon
Position	Tutor
Duration	1999-2004

### Teaching Experiences

Position	Lecturer at Info Myanmar College
Modules	Programming, programming in java, Database Design and Development
Level	Higher National Diploma in Computing (QCF,RQF) (Present)
Position	Assistant Lecturer at University of Computer Studies, Yangon
Modules	Programming Language, Database, Data Structure, Data mining, Operating System
Level	1st Year, 2 <sup>nd</sup> Year, 3 <sup>rd</sup> Year, Hons: M.C.Sc, D.C.Sc, M.I.Sc(1999-2008)
Position	Senior Lecturer at New Horizon
Modules	Advance Java Programming(J2SE)
Level	Postgraduate(2018)
Position	Senior Lecturer at UNL
Modules	Advance Java Programming, ASP.Net
Level	Postgraduate(2015-2018)

### Membership of Professional bodies/institutions

Professional Member, Myanmar Computer Professional Association(MCPA)



## Info Myanmar University



**Daw Kay Thwe Hline**

**Lecturer**

### Personal Details

Address	: No. 10/12 ,3 <sup>rd</sup> floor,53 <sup>rd</sup> Street, Botataung township ,Yangon.
Contact Phone	: +95-01-512119
Email	: kthwehline72@gmail.com
Date of Birth	: 28.2.1972

### Educations and Qualifications

Title	:M. I. Sc
Awarding Organisation	:University of Computer Studies, Yangon
Duration	:1998
Title	:M.Sc. (Maths.)(QII)
Awarding Organisation	:Yangon University
Duration	:1996
Title	:B.Sc. (Maths.)
Awarding Organisation	:Yangon University
Duration	:1994

### Industrial and Commercial Experiences

Name of Organisation	Info Myanmar College
Position	Lecturer
Duration	5.12.2018
Name of Organisation	University of Computer Studies, Yangon
Position	Assistant Lecturer
Duration	2004-2005
Name of Organisation	University of Computer Studies, Yangon
Position	Tutor
Duration	1999-2004





## Teaching Experiences

Position	Lecturer at Info Myanmar College
Modules	Maths for Computing
Level	Higher National Diploma in Computing (RQF)
Position	Private computing maths
Modules	Discrete Maths , Computing Maths .
Level	1st Year, 2 <sup>nd</sup> Year, 3 <sup>rd</sup> Year, (U.C.SY, U.I.T)
Position	Assistant Lecturer at University of Computer Studies, Yangon
Modules	Data Structure, Computing Maths.
Level	1st Year, 2 <sup>nd</sup> Year, 3 <sup>rd</sup> Year, D.C.Sc,



## Info Myanmar University



**Daw Ohnma Khine**

**Lecturer**

### Personal Details

Address	: 34/4 fl, Eaiksathaya Street, Kyauk Myaung, Tamwe township, Yangon.
Contact Phone	: +95-01-512119
Email	: <a href="mailto:kaunghtet5006@gmail.com">kaunghtet5006@gmail.com</a>
Date of Birth	: 11.3.1975

### Educations and Qualifications

Title	:M.Sc. (Maths)
Awarding Organisation	:Mandalay University
Duration	:2002
Title	:M.I.Sc. (Credit)
Awarding Organisation	:U.C.S.M.
Duration	:2003
Title	:B.Sc. (Hons.) Maths
Awarding Organisation	:Mandalay University
Duration	:2000
Title	:D.C.Sc.
Awarding Organisation	:U.C.S.M.
Duration	:2002



## Industrial and Commercial Experience

Name of Organisation	Info Myanmar College
Position	Lecturer
Duration	March 2019 to at Present
Name of Organisation	Computer University ( Myitkyina )
Position	Tutor
Duration	August 2003 to October 2005
Name of Organisation	University of Computer Studies, Yangon
Position	Tutor
Duration	November 2005 to December 2009
Name of Organisation	Computer University ( Taunggu )
Position	Tutor
Duration	January 2010 to June 2010
Name of Organisation	Glory Carrier Training Centre
Position	Lecturer (Part Time)
Duration	August 2010 to October 2018
Name of Organisation	Essential IT Training Centre
Position	Part Time Teacher
Duration	2010 to February 2019

## Teaching Experience

Position	Lecturer at Info Myanmar College
Modules	Maths for Computing
Level	HND Diploma, Pearson Education
Position	Tutor at Computer University ( Myitkyina )
Modules	Maths, Operational Research, C G, O-O-S-D.
Level	2 <sup>nd</sup> year, 3 <sup>rd</sup> year, Honours, D.C.Sc.
Position	Tutor at University of Computer Studies, Yangon
Modules	Data Structure, A I, C G, C T.
Level	1 <sup>st</sup> year, 3 <sup>rd</sup> year, Honours, D.C.Sc.
Position	Tutor at Computer University ( Taunggu )
Modules	A I, C G.
Level	3 <sup>rd</sup> year, Honours,
Position	Lecturer (Part Time) at GLORY Career Training Centre
Modules	City & Guide Course
Level	Diploma in Electrical and Electronic Engineering (UK)
Position	Part Time Teacher at Essential IT Training Centre
Modules	Operational Research, Maths for Computing, Computer Graphic
Level	Bachelors and Honours in IT





## Info Myanmar University



**Daw May Soe Htay**

**Lecturer**

### Personal Details

Address	: San Yeik Nein(1),No.8, 6 <sup>th</sup> floor ,Hledan Yangon
Contact Phone	: +95-01-512119
Email	: maysoe90@gmail.com
Date of Birth	: 12.9.1985

### Educations and Qualifications

Title	:M.C.Sc
Awarding Organisation	:University of Computer Studies, Yangon
Duration	:2008
Title	:B.C.Sc(Hons:)
Awarding Organisation	:Universities of Computer Studies(Hinthada)
Duration	:2005
Title	:B.C.Sc
Awarding Organisation	: Universities of Computer Studies(Hinthada)
Duration	:2004



## Industrial and Commercial Experience

Name of Organisation	Info Myanmar College
Position	Lecturer
Duration	26.12.2018
Name of Organisation	University of Computer Studies(Dawei)
Position	Lecturer
Duration	2018, December
Name of Organisation	University of Information Technology(UIT)
Position	Assistant Lecturer
Duration	2015 to 2018
Name of Organisation	University of Computer Studies(Dawei)
Position	Tutor
Duration	2012 to 2015
Name of Organisation	University of Computer Studies(Maubin)
Position	Tutor
Duration	2007 to 2012

## Teaching Experience

Position	Lecturer at Info Myanmar College
Modules	Programming, Professional Practice, E-commerce, SAD
Level	Higher National Diploma in Computing (QCF, RQF) Present
Position	Lecturer at University of Computer Studies(Dawei)
Modules	Design and Analysis of Algorithm, Java
Level	4 <sup>th</sup> Year and 2 <sup>nd</sup> Year (2018,December)
Position	Assistant Lecturer at University of Information Technology(UIT)
Modules	Programming Language, Data Structure, Design and Analysis of Algorithm, C++, IP(Technology)
Level	1st Year, 2 <sup>nd</sup> Year, 3 <sup>rd</sup> Year, 4 <sup>th</sup> Year, IT Passport Training (from 2015 to 2018)
Position	Tutor at University of Computer Studies(Dawei)
Modules	Programming Language, Data Structure, Design and Analysis of Algorithm, C++, Compiling Technique
Level	1st Year, 2 <sup>nd</sup> Year, 3 <sup>rd</sup> Year, 4 <sup>th</sup> Year (from 2012 to 2015)
Position	Tutor at University of Computer Studies(Maubin)
Modules	Java, Data Structure, Computer Organization, UML, Design and Analysis of Algorithm, Parallel Algorithm
Level	1st Year, 2 <sup>nd</sup> Year, 3 <sup>rd</sup> Year, Hons., Master, M.I.Sc , D.C.Sc (from 2007 to 2012)



## Info Myanmar University



**Mya Kay Thwe Tun @ Sylvia  
Law**

**Head of English Department  
(Acting)**

### Personal Details

Address	: 25,Pyi Thar Yar Road, Baukhtaw, Yankin, Yangon.
Contact Phone	: +95-01-512119
Email	: sylvia.success.ygn@gmail.com
Date of Birth	: 12.11.1981

### Educations and Qualifications

Title	: M.B.A
Awarding Organisation	: Yangon Institute of Economics
Duration	: 2008
Title	: B.A (English)
Awarding Organisation	: Yangon University of Foreign Languages
Duration	: 2005
Title	: I.A.D.C.S
Awarding Organisation	: N.C.C (UK)
Duration	: 2005
Title	: I.D.E.C
Awarding Organisation	: N.C.C (UK)
Duration	: 2004
Title	: TESOL Certificate
Awarding Organisation	: Chister College (UK)
Duration	: Feb, 2014





### Industrial and Commercial Experiences

Name of Organisation	Info Myanmar College
Position	Head of English Department (Acting)
Duration	April, 2018- Present
Name of Organisation	Info Myanmar College
Position	English Lecturer (Acting)
Duration	8 February, 2018- 31 <sup>st</sup> March, 2018
Name of Organisation	Ivy Bound International School (Bangkok, Thailand)
Position	Curriculum Coordinator (English)
Duration	September 2015- September 2016
Name of Organisation	Saint John International School (Bangkok, Thailand)
Position	ESL Teacher
Duration	August 2014 – June 2015
Name of Organisation	Success Language Academy ( Yangon, Myanmar)
Position	English Language Instructor
Duration	2008-2013

### Teaching Experiences

Position	English Lecturer at Info Myanmar College
Modules	English ( General Four Skills, VEPT and IELTS)
Level	From Beginner to Intermediate Level
Position	Curriculum Coordinator at Ivy Bound International School (Bangkok, Thailand)
Modules	English (General Four Skills)
Level	From 6 months to 6 years old babies
Position	ESL Teacher at Saint John International School (Bangkok, Thailand)
Modules	English ( General Four Skills, KET, PET and IELTS)
Level	From Grade 4 to Grade 12
Position	English Language Instructor at Success Language Academy ( Yangon, Myanmar)
Modules	English (General Four Skills and IELTS)
Level	From Beginner to Intermediate Level



## Info Myanmar University



**Daw Hnin Wai Wai Hlaing**

**Lecturer**

### Personal Details

Address	: No 156, Mayen Myain Street, Hlaing Township, Yangon
Contact Phone	: +95 – 01 -512119
Email	: <a href="mailto:hninwaiwaihlaing@infomyanmarcollege.com">hninwaiwaihlaing@infomyanmarcollege.com</a>
Date of Birth	: 23.4.1988

### Educations and Qualifications

Title	: M.C.Sc
Awarding Organisation	: University of Computer Studies, Yangon
Duration	: 2010
Title	: B.C.Sc (Hons)
Awarding Organisation	: University of Computer Studies, Yangon
Duration	: 2008
Title	: B.C.Sc
Awarding Organisation	: University of Computer Studies, Yangon
Duration	: 2007
Title	: Fundamental Information Technology Engineer (FE)
Awarding Organisation	: Information Technology Professional Exam Council(ITPEC)
Duration	: Oct, 2014



### Industrial and Commercial Experience

Name of Organisation	Info Myanmar College
Position	Lecturer
Duration	2015 - Present
Name of Organisation	UMG (Myanmar)
Position	Team Leader of ITDP (Special Program 2)
Duration	2013 to 2015
Name of Organisation	PROWORLD Computer Training Centre
Position	Teacher
Duration	2008 to 2013

### Teaching Experience

Position	Lecturer at Info Myanmar College
Modules	Programming Languages, Web Application Technologies, Database Technologies
Level	HND students
Position	Team Leader at UMG Myanmar
Modules	Web Application with ASP.Net, MS SQL Server
Level	IT Graduated
Position	Teacher at PROWORLD Computer Training Centre
Modules	Programming Languages, Database, Computer Basic, Advanced Excel, MYOB
Level	Undergraduate level

### Membership of Professional bodies/institutions

Associate Member, MCPA

### Published Papers

Title	Evaluation of Diagnosis according to Myanmar Traditional Medicine by using Exception Maximization
Year	2010





## Info Myanmar University



**U Chan Thar Soe**  
**Lecturer**

### Personal Details

Address	: NO. 198, fifth floor (A), Kyun Taw Street, Mount (south) Ward, Sanchaung Township, Yangon
Contact Phone	: +95 -01-512119
Email	: chantharchanthar34@gmail.com
Date of Birth	: 9.5.1986

### Educations and Qualifications

Title	:BA. (English)
Awarding Organisation	:Dagon University
Duration	:2002-2005
Title	:Master of Professional Studies in Public Administration
Awarding Organisation	:Aldersgate College, Philippines
Duration	:2014-2016
Title	:Diploma in Buddhism
Awarding Organisation	:International Theravada Buddhist Missionary University
Duration	:2008-2009
Title	:Diploma in English Language Teaching Methodology
Awarding Organisation	:Yangon University of Education
Duration	:2009-2010
Title	:Diploma in English Language Teaching
Awarding Organisation	:Yangon University of Foreign Languages
Duration	:2012-2013
Title	:Executive Diploma in Human Resource Management
Awarding Organisation	:London Examinations Board, Certa.
Duration	:2018-2018



### Industrial and Commercial Experience

Name of Organisation	International Grand Hanthar Hospital
Position	English Language Teacher (Head)
Duration	2014-2014
Name of Organisation	Kaung Su Wai Language Center
Position	English Language Trainer
Duration	2011-2014
Name of Organisation	Yangon University of Education
Position	Tutor
Duration	2016-2017
Name of Organisation	Pyin Nyar Shwe Sin Private High School
Position	English Teacher (Dean)
Duration	2015-2016
Name of Organisation	Civic Society Initiative (CSI), British Council Myanmar
Position	English Language Teacher
Duration	2010-2011

### Teaching Experience

Position	International Grand Hanthar Hospital
Modules	Unit 1 to 12
Level	Upper Intermediate Level
Position	Kaung Su Wai English Language Centre
Modules	Unit 1 to 16
Level	Advanced Level
Position	Yangon University of Education
Modules	First Year, Second Year and Third Year of BE.d
Level	Advanced Level
Position	Civic Society Initiative (CSI)
Modules	Unit 1 to 12
Level	Young Learner

### Membership of Professional bodies/institutions

Teaching English Abroad and Centre for Strategic and International Studies



## Info Myanmar University



**Daw Thi Thi Thandar Saw Htay**

**Lecturer**

### Personal Details

Address	: No.6/2B: 2nd kyun chan street, Kamayut Township, Yangon, Myanmar
Contact Phone	: +95 – 01 - 512119
Email	: thithithandar@gmail.com
Date of Birth	: 1-3-1985

### Educations and Qualifications

Title	:M.C.Tech
Awarding Organisation	:University of computer studies (Mandalay)
Duration	:2009
Title	:B.C.Tech (Hons)
Awarding Organisation	:University of computer studies (Meikhtila)
Duration	:2006
Title	: B.C.Tech
Awarding Organisation	: University of computer studies (Meikhtila)
Duration	:2005





### Industrial and Commercial Experience

Name of Organisation	Info Myanmar College
Position	Assistant Lecturer
Duration	2017 - Present
Name of Organisation	University of Computer Studies (Taungoo)
Position	Tutor
Duration	2014- 2017
Name of Organisation	University of computer studies (Meikhtila)
Position	Tutor
Duration	2009 - 2014

### Teaching Experience

Position	Assistant Lecturer at Info Myanmar College
Modules	Unit-24 Networking Technologies, Unit-27 Network Operating Systems Unit-25 Routing Concepts Unit-43 Networking Infrastructure Unit-2 Networking
Level	HND( Level 5) HNC ( level 4)
Position	Tutor at University of computer studies (Taungoo)
Modules	Computer Architecture Digital Control Computer Networking Advanced Networking
Level	Bachelor, Hons
Position	Tutor at University of computer studies (Meikhtila)
Modules	Electronic Devices Digital Control Computer Networking TCP/IP
Level	Bachelor, Hons, Master



## Info Myanmar University



**Daw Thinzar Soe**

**Instructor**

### Personal Details

Address	:No (2109),Kant Kaw Street,Zay Yar Thiri Quarter, Mawlamyine, Mon State
Contact Phone	: +95-01-512119
Email	: dawthinzarsoe123@gmail.com
Date of Birth	: 25.3.1994

### Educations and Qualifications

Title	:M.C.Sc.
Awarding Organisation	:University of Computer Studies, Yangon
Duration	:Feb 03, 2019
Title	:B.C.Sc. (Hons.)
Awarding Organisation	:University of Computer Studies, Thaton
Duration	:Feb 21, 2016
Title	:B.C.Sc.
Awarding Organisation	:University of Computer Studies, Thaton
Duration	:Feb 16, 2014
Title	:Professional Diploma in Java Programming
Awarding Organisation	:India-Myanmar Center for Enhancement of IT Skills, Yangon
Duration	:May 06, 2016
Title	:Web Technologies
Awarding Organisation	:India-Myanmar Center for Enhancement of IT Skills, Yangon
Duration	:July 10, 2016



### Industrial and Commercial Experience

Name of Organisation	Info Myanmar College
Position	Instructor
Duration	10/1/2017 - Present

### Teaching Experience

Position	Instructor at Info Myanmar College
Modules	Procedural Programming, Website Design, Programming, Object Oriented Programming, Web Applications Development, Professional Practice
Level	Higher National Diploma in Computing (QCF, RQF)

### Membership of Professional bodies/institutions

Student Member, Myanmar Computer Professional Association (MCPA)
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### Published Papers

Title	Web Searching Based on Clustering Approach
Year	2017





## Info Myanmar University



**Daw Hnin Yi San**

**Instructor**

### Personal Details

Address	: No(47), Ma Gyi Gyi street, San Chaung township, Yangon, Myanmar
Contact Phone	: +95-01-512119
Email	: khineyuwartun@gmail.com
Date of Birth	: 16.7.1994

### Educations and Qualifications

Title	:M.C.Sc.
Awarding Organisation	:University of Computer Studies, Yangon
Duration	:Feb 03, 2019
Title	:B.C.Sc. (Hons.)
Awarding Organisation	:University of Computer Studies, Thaton
Duration	:Feb 21, 2016
Title	:B.C.Sc.
Awarding Organisation	:University of Computer Studies, Thaton
Duration	:Feb 16, 2014
Title	:Professional Diploma in Java Programming
Awarding Organisation	:India-Myanmar Center for Enhancement of IT Skills, Yangon
Duration	:May 06, 2016
Title	:Web Technologies
Awarding Organisation	:India-Myanmar Center for Enhancement of IT Skills, Yangon
Duration	:July 10, 2016
Title	:Certified Andriod Basic
Awarding Organisation	:LogicUnion Programming Training Center
Duration	:Jan 05, 2017



### Industrial and Commercial Experience

Name of Organisation	Info Myanmar College
Position	Instructor
Duration	10.1.2017 - Present

### Teaching Experience

Position	Instructor at Info Myanmar College
Modules	Procedural Programming, Website Design, Programming, Object Oriented Programming
Level	Higher National Diploma in Computing(QCF, RQF)

### Membership of Professional bodies/institutions

Student Member, Myanmar Computer Professional Association (MCPA)
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### Published Papers

Title	Comparison of Classification Methods on Software Defect Data Sets
Year	2018



## Info Myanmar University



**Daw Saint Saint San**  
**Instructor**

### Personal Details

Address	: 28/4 Butor Yone Street, Hlaing .Yangon
Contact Phone	: +95-01-512119
Email	: <a href="mailto:saintsaintsananni22@gmail.com">saintsaintsananni22@gmail.com</a>
Date of Birth	: 8/3/1994

### Educations and Qualifications

Title	: M.C.Sc.(Thesis)
Awarding Organisation	: University of Computer Studies, Yangon
Duration	: -
Title	: B.C.Sc. (Hons.)
Awarding Organisation	: University of Computer Studies, Pyay
Duration	: Feb 21, 2016
Title	: B.C.Sc.
Awarding Organisation	: University of Computer Studies, Pyay
Duration	: Feb 16, 2014
Title	: Professional Diploma in Java Programming
Awarding Organisation	: India-Myanmar Center for Enhancement of IT Skills, Yangon
Duration	: May 06, 2016
Title	: Intermediate English
Awarding Organisation	: Star Fish Education
Duration	: Feb.1.2018





Title	:First Prize ( Master Level of English Debate Competition)
Awarding Organisation	: University of Computer Studies, Yangon
Duration	:-

### Industrial and Commercial Experience

Name of Organisation	Info Myanmar College
Position	Instructor
Duration	10.1.2017- up to present

### Teaching Experience

Position	Instructor at Instructor at Info Myanmar College
Modules	Procedural Programming, Data Analysis And Design, Database Design and Development, Programming, Object Oriented Programming, Professional Practice
Level	Higher National Diploma in Computing(QCF, RQF)

### Membership of Professional bodies/institutions

Student Member, Myanmar Computer Professional Association (MCPA)
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## Info Myanmar University



**Daw Nandar Moh Moh Lwin**

**Instructor**

### Personal Details

Address	No-78/Aung Thu Kha Street, Sinmalite, Kamayut
Contact Phone	: +95 – 01 - 512119
Email	: nandarmohmohlwinucsy@gmail.com
Date of Birth	: 20-5-1995

### Educations and Qualifications

Title	:Master of Computer Science(M.C.Sc Thesis)
Awarding Organisation	:University of Computer Studies, Yangon
Duration	:2017 to now
Title	:Master of Computer Science(M.C.Sc Course Work)
Awarding Organisation	:University of Computer Studies, Yangon
Duration	:2015 to 2016
Title	:Bachelor of Computer Science
Awarding Organisation	:University of Computer Studies, Maubin
Duration	:2011 to 2015

### Industrial and Commercial Experience


Name of Organisation	:Info Myanmar College
Position	:Instructor
Duration	:15/7/2017 to now

### Teaching Experience

Position	Instructor at Info Myanmar College
Modules	Website, OOP, Website Design, Web Applications Development, Database Design and Development, Java Programming
Level	Pre HND, HND Diploma



## Info Myanmar University

	<p><b>Daw Tin Ni Lar Win</b></p> <p><b>Instructor</b></p>
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### Personal Details

Address	: No(81), (27) street, Pabedan Township.
Contact Phone	: +95-01-512119
Email	: tinnilarwin21195@gmail.com
Date of Birth	: 22.2.1995

### Educations and Qualifications

Title	:M.C.Sc(Thesis)
Awarding Organisation	:University of Computer Studies, Yangon
Duration	:Current
Title	:B.C.Sc
Awarding Organisation	:University of Computer Studies, Maubin
Duration	:Feb 21, 2016
Title	: Certified Web Design
Awarding Organisation	: Logic Union Programming Training Center
Duration	:March 11, 2017
Title	:Certificate in foundation of Leadership and Capacity Development
Awarding Organisation	:Youth Social Force (Myanmar Charitable Youth Association)
Duration	:Feb 7, 2019

### Industrial and Commercial Experience

Name of Organisation	Info Myanmar College
Position	Instructor
Duration	6-8-2018





Teaching Experiences	
Position	White Jasmine Association
Modules	Teaching & knowledge sharing for health
Level	
Position	Instructor at Info Myanmar College
Modules	Application, Website Design,
Level	

Membership of Professional bodies/institutions
Volunteer at White Jasmine Association



## Info Myanmar University



**Daw Myint Myint Moe**

**Operation Lead Staff**

### Personal Details

Address	: No. 2 , Zaya Thitsar Street, Hlaing Township, Yangon.Myanmar.
Contact Phone	: +95 – 01- 512119
Email	: -
Date of Birth	: 5.6.1988

### Educations and Qualifications

Title	: M.A (Phil)
Awarding Organisation	: Monywa University
Duration	: 2013 - 2014
Title	: B.A (Phil) Q
Awarding Organisation	: Monywa University
Duration	: 2010 – 2011

### Industrial and Commercial Experience

Name of Organisation	: Student Service, Info Myanmar College
Position	: Operation Lead Staff
Duration	: July 2018



## Info Myanmar University



**Daw Kay Khaing Win**

**Accountant**

### Personal Details

Address	: No(4) 6 <sup>th</sup> Street, Hledan Zay, Kamayut
Contact Phone	: +95 – 01- 512119
Email	: Kaykhinewin673@gmail.com
Date of Birth	: 15 May 1988

### Educations and Qualifications

Title	: M.Sc (Phys)
Awarding Organisation	: Mawlamyine University
Duration	: 2012
Title	: LCCI Level I, II, III
Awarding Organisation	: LCCI, UK
Duration	: 2014 - 2015

### Industrial and Commercial Experience

Name of Organisation	: IMCS Co., Ltd
Position	: Accountant
Duration	: Jun 2016 to Present
Name of Organisation	: Maganate Co., Ltd
Position	: Accountant
Duration	: Jan 2016 to Jun 2016
Name of Organisation	: J Phone Mobile
Position	: Accountant
Duration	: Oct 2015 to Dec 2016
Name of Organisation	: Audit Firm
Position	: Account (Junior)
Duration	: April 2015 to Sep 2015





## Published Papers

Title	Tracing of Nuclear Tracks Using Solid State of Nuclear Track Detectors Technique
Year	2012



## Info Myanmar University

	<p><b>U Han Win Aung</b></p> <p><b>Engineer</b></p>
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### Personal Details

Address	: No(169), Kunchan (3) Street, Kamayut, Yangon
Contact Phone	: +95 – 01 - 512119
Email	: hanwinaung20@gmail.com
Date of Birth	: 8 May 1987

### Educations and Qualifications

Title	: B.A (Myanmar)
Awarding Organisation	: Western Yangon University
Duration	: 2011-2013
Title	: AGTI
Awarding Organisation	: Taungoo Technological University
Duration	: 2004-2006

### Industrial and Commercial Experience

Name of Organisation	: Info Myanmar College
Position	: M&E Engineer
Duration	: (1.9.2015) - Present
Name of Organisation	: (O&M) Zamilinfru
Position	: Field Engineer
Duration	: (18.4.15) – (30.7.15)
Name of Organisation	: Higher Myanmar Technolgies
Position	: Training Engineer
Duration	: (17.4.13) to (17.4.15)
Name of Organisation	: Myaing Hay Won Food Center
Position	: Assistant Engineer
Duration	: (1.9.12) – (31.3.13)
Name of Organisation	: Victoria shopping Mall Super One Group
Position	: Maintenance Engineer (Incharge)
Duration	: (10.11.07) – (30.8.12)



## Info Myanmar University



**U Kaung Da Na Htet**

**Lecturer**

### Personal Details

Address	: 142/2, Kyauk Sane Street, Thuwana, 24 Ward, Thingangyun Tsp
Contact Phone	: +95 -1- 512119
Email	: kaungdanahtet@outlook.com
Date of Birth	: April 10, 1995

### Educations and Qualifications

Title	: Computer Hacking Forensic Investigator - CHFI
Awarding Organisation	: International Council of Electronic Commerce Consultants (EC-Council)
Duration	: 2018-2019
Title	: Certified Ethical Hacker,v9 - CEH
Awarding Organisation	: International Council of Electronic Commerce Consultants (EC-Council)
Duration	: 2017-2018
Title	: Certified Secure Computer User – CSCU
Awarding Organisation	: International Council of Electronic Commerce Consultants (EC-Council)
Duration	: 2015-2016
Title	: B.A - English
Awarding Organisation	: Dagon University
Duration	: 2015-2016
Title	: Microsoft Certified Professional – MCP 70-411
	: Microsoft Corporation
	: 2015-2016
Awarding Organisation	: Cisco Certified Network Associated - CCNA
Duration	: Cisco Systems, Inc
Title	: 2013-2014





### **Industrial and Commercial Experience**

Name of Organisation	Info Myanmar College (IMC)
Position	Lecturer
Duration	2012 - Present

### **Teaching Experience**

Position	Info Myanmar College (IMC)
Modules	Networked Service, Computer System
Level	B.Sc Computing (ENU)
Position	Info Myanmar College (IMC)
Modules	Networked Service, Computer System
Level	Higher National Diploma, Pearson Education



## Info Myanmar University



**U Hein Min Aung**

**System Administrator**

### Personal Details

Address	: No(777) 3B, Gadamar St, Mayangone Tsp; Yangon
Contact Phone	: +95 – 01 - 512119
Email	: heinmin1592@gmail.com
Date of Birth	: 11 September 1992

### Educations and Qualifications

Title	: HND
Awarding Organisation	: Pearson Education
Duration	: 2018_ Present
Title	: CCNP
Awarding Organisation	: CISCO Cooperation
Duration	: 2018
Title	: CCNA
Awarding Organisation	: CISCO Cooperation
Duration	: 2015
Title	: MCSA
Awarding Organisation	: Microsoft Cooperation
Duration	: 2018
Title	: Certificate in Service+ Engineering
Awarding Organisation	: IMCS
Duration	: 2013
Title	: Certificate in Network Engineering
Awarding Organisation	: KMD
Duration	: 2012



Industrial and Commercial Experience	
Name of Organisation	: Info Myanmar College
Position	: System Administrator
Duration	: 2019-Present
Name of Organisation	: IMCS Co., Ltd
Position	: Lecturer
Duration	: 2013-2019



## Info Myanmar University



**U Tun Aung**

**Assistant Lecturer**

### Personal Details

Address	: No(20).MauPin st,SanChaung township,Yangon
Contact Phone	: +95-01-512119
Email	: Tunaung.1991@gmail.com
Date of Birth	: 23.11.1991

### Educations and Qualifications

Title	:BA(MYNAMAR)
Awarding Organisation	:University of East Yangon
Duration	:2009-2012
Title	:Network engineer
Awarding Organisation	:IMCS Co., Ltd.
Duration	:2008
Title	:Hardware Engineer
Awarding Organisation	: IMCS Co., Ltd.
Duration	:2008

### Teaching Experience

Position	: IMCS Co., Ltd.
Modules	: Hardware A+, Network N+
Level	: Certificate Course





## Info Myanmar University



**Daw Hnin Ei Phyu**

**Assistant Lecturer**

### Personal Details

Address	: No. 6 (2B), Kon Chan Gone (2) St, Kamayut Twsp, Yangon.
Contact Phone	: +95 – 1 - 512119
Email	: eiphyu311293@gmail.com
Date of Birth	: 31/ 7 /1993

### Educations and Qualifications

Title	: VMWare (Boot Camp)
Awarding Organisation	: MCPA
Duration	: May 2017
Title	: CCNP (Switching)
Awarding Organisation	: Cisco
Duration	: September 2016
Title	: CCNA (Routing and Switching)
Awarding Organisation	: Cisco
Duration	: November 2013
Title	: MCP
Awarding Organisation	: Microsoft
Duration	: July 2013
Title	: Service+ Engineering
Awarding Organisation	: IMCS Computer Training Centre
Duration	: June 2013
Title	: B.C.Sc
Awarding Organisation	: Computer University (Myitkyina)
Duration	: February, 2013



### Industrial and Commercial Experience

Name of Organisation	Info Myanmar College (IMC)
Position	Assistant Lecturer
Duration	2015- current
Name of Organisation	Info Myanmar College (IMC)
Position	Senior Instructor
Duration	2015
Name of Organisation	IMCS Computer Training Centre
Position	Instructor
Duration	2014

### Teaching Experience

Position	IMC (Info Myanmar College)
Modules	Wireless Local Area Network
Level	SCQF Level 10
Position	IMC (Info Myanmar College)
Modules	IT-Virtualization, Internet Server Management
Level	QCF Level 5 (HND)
Position	IMC (Info Myanmar College)
Modules	Routing Concepts, Network Operating Systems, Networking, Networking Technologies, Computer System, Networking
Level	QCF Level 4 (HNC), RQF Level 4
Position	IMCS Computer Training Centre
Modules	CCNA
Level	Routing and Switching
Position	IMCS Computer Training Centre
Modules	Service+ Engineering
Level	Hardware, Network, Server,

### Membership of Professional bodies/institutions

-Associate Member of Myanmar Computer Professional Association.



## Info Myanmar University



**Daw Zin Mar Tun**

**Assistant Lecturer**

### Personal Details

Address	: No. 6 (2B), Kon Chan Gone (2) St, Kamayut Twsp, Yangon.
Contact Phone	: +95-01-512119
Email	: <a href="mailto:zinmartun.martun@gmail.com">zinmartun.martun@gmail.com</a>
Date of Birth	: 15 <sup>th</sup> Sep, 1992

### Educations and Qualifications

Title	: CHFI (Computer Hacking Forensics Investigator)
Awarding Organisation	: EC- Council
Duration	: 23 <sup>rd</sup> March, 2019
Title	: CCNP (Switching)
Awarding Organisation	: Cisco
Duration	: 30 <sup>th</sup> May, 2018
Title	: MCP (70-411, 70- 410)
Awarding Organisation	: Microsoft
Duration	: January, 2018
Title	: CCNA (Routing and Switching)
Awarding Organisation	: Cisco
Duration	: 1 <sup>st</sup> June, 2015
Title	: Service+ Engineering
Awarding Organisation	: IMCS Computer Training Centre
Duration	: since 2012
Title	: BSc (Computer Science)
Awarding Organisation	: Dagon University
Duration	: February, 2011



### Industrial and Commercial Experience

Name of Organisation	Info Myanmar College (IMC)
Position	Assistant Lecturer
Duration	2018-2019
Name of Organisation	Info Myanmar College (IMC)
Position	Senior Instructor
Duration	2017-2018
Name of Organisation	IMCS Computer Training Centre
Position	Senior Instructor
Duration	2016-2017
Name of Organisation	IMCS Computer Training Centre
Position	Instructor
Duration	2015-2016

### Teaching Experience

Position	IMC (Info Myanmar College)
Modules	Networking Infrastructure(NI), Network Security(NS), Local Area Network Technologies(LAN) , Internet Server Management(ISM)
Level	Level 5 HND
Position	IMC (Info Myanmar College)
Modules	Routing Concepts(RC), Network Operating Systems(NOS), Networking, Networking Technologies(NT)
Level	Level 4 HNC
Position	IMCS Computer Training Centre
Modules	CCNA
Level	Routing and Switching
Position	IMCS Computer Training Centre
Modules	Service+ Engineering
Level	Hardware, Network, Server





## Info Myanmar University



**Daw Hay Mar Lwin**

**Lecturer**

### Personal Details

Address	: No.60, Ground, Baya thokedi street, kyauk myaung, Tamwe
Contact Phone	: 0941005648
Email	: hmlwin.mm@gmail.com
Date of Birth	: 19.1.1990

### Educations and Qualifications

Title	: BTech-IT
Awarding Organisation	: Thanlyin Technological University
Duration	: 2010-2011
Title	: Bachelor of Engineering (BE-IT)
Awarding Organisation	: Thanlyin Technological University
Duration	: 2011-2012
Title	: Practical A+
Awarding Organisation	: Youth Computer Co.Ltd
Duration	: 2012
Title	: Networking
Awarding Organisation	: Youth Computer Co.Ltd
Duration	: 2012
Title	: Cisco Certified Network Associate
Awarding Organisation	: IMCS Co.Ltd
Duration	: 2013



### Industrial and Commercial Experience

Name of Organisation	Call Center
Position	Team Leader of m188 mobile application services
Duration	2012
Name of Organisation	IMCS Company ltd
Position	Instructor
Duration	2012
Name of Organisation	IMCS Company Ltd
Position	Assistant lecturer
Duration	2012-2013
Name of Organisation	IMCS Company Ltd
Position	Lecturer
Duration	2013-2014
Name of Organisation	Info Myanmar College
Position	Lecturer
Duration	2014 - Present

### Teaching Experience

Position	IMCS Company ltd
Modules	Practical A+
Level	Service+ Engineering (Hardware) Service+ Engineering (Network)
Position	Info Myanmar College
Modules	Computer Systems (Unit-2) Computer Systems and Architecture (Unit-8) Network Operating System (Unit-27)
Level	ICT (Pre-HND)



## Info Myanmar University



**U Tin Htoo Zaw**  
**Lecturer**  
**(QCF Programme Leader)**

### Personal Details

Address	: 20/B U Aung Zaya 6 <sup>th</sup> St. Bayint Qt, Yangon
Contact Phone	: +95 – 1- 512119
Email	: httoozawhzmt@gmail.com
Date of Birth	: 30 <sup>th</sup> Oct 1987

### Educations and Qualifications

Title	: CEH
Awarding Organisation	: EC Council
Duration	: 2017
Title	: CCNA Security
Awarding Organisation	: Cisco
Duration	: 2016
Title	: CCNA Routing and Switching
Awarding Organisation	: Cisco
Duration	: 2013
Title	: B.A (Myanmar)
Awarding Organisation	: UDE
Duration	: 2007-2008



### Industrial and Commercial Experience

Name of Organisation	Info Myanmar College
Position	Lecturer
Duration	2015 - Present
Name of Organisation	Hornbill
Position	Technician
Duration	2008 – Current
Name of Organisation	ACE Electronics
Position	Service Engineer
Duration	2008 – Current

### Teaching Experience

Position	Info Myanmar College
Modules	Network Specialize
Level	B.Sc (Computing), Edinburgh Napier University
Position	Info Myanmar College
Modules	Network Specialize
Level	HND Diploma, Pearson Education
Position	MNC
Modules	Network Specialize
Level	HND Diploma, Pearson Education
Position	Nawaratt
Modules	Hardware Specialize
Level	Certificate Level
Position	Quick Computer
Modules	HW & NW
Level	Certificate Level





## Info Myanmar University



**U Naing Min Aung**

**Assistant Lecturer**

### Personal Details

Address	: No(64), 3A, Myaynigone Market St, Sanchaung Tsp; Yangon
Contact Phone	: +95 – 01 - 512119
Email	: naingminaung21noe1@gmail.com
Date of Birth	: 2 January 1993

### Educations and Qualifications

Title	: Hardware (A+)
Awarding Organisation	: IMCS
Duration	: 2010
Title	: Network (N+)
Awarding Organisation	: IMCS
Duration	: 2011
Title	: Server 2008/CCNA
Awarding Organisation	: IMCS
Duration	: 2012
Title	: B.Sc (phycs)
Awarding Organisation	: IMCS
Duration	: 2014
Title	: CCNA Online Qualification
Awarding Organisation	: -
Duration	: 2018



### **Industrial and Commercial Experience**

Name of Organisation	: Royal Smart Company
Position	: Assistant Manager/ Team Leader
Duration	: May 2011-January 2016
Name of Organisation	: Info Myanmar College
Position	: Assistant Lecturer
Duration	: February 2016-Present



## Info Myanmar University

	<b>U Tun Aung Thein</b>  <b>Lecturer</b>
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### Personal Details

Address	: No(39).1-Htuperyone (2) St, Tharkayta Township, Yangon
Contact Phone	: +95 – 1- 512119
Email	: tunaungthein.it@gmail.com
Date of Birth	: 11.10.1977

### Educations and Qualifications

Title	:CCNP (Route)
Awarding Organisation	: IMC
Duration	:2016
Title	:CCNP (Switch)
Awarding Organisation	: AGB Network Academy Training Centre
Duration	:2016
Title	:CCNA
Awarding Organisation	:AGB Network Academy Training Centre
Duration	:2015
Title	:MTCNA
Awarding Organisation	: AGB Network Academy Training Centre
Duration	:2015
Title	:Network Engineering
Awarding Organisation	:KMD Computer Centre
Duration	:2007
Title	:BA(History)
Awarding Organisation	:University of East Yangon
Duration	:2001-2005



### Industrial and Commercial Experience

Name of Organisation	Info Myanmar College (IMC)
Position	Lecturer
Duration	2016 – current
Name of Organisation	AGB Computer Training Centre
Position	Lecturer
Duration	2015-2016
Name of Organisation	IMCS Computer Training Centre
Position	Lecturer
Duration	2011- 2015
Name of Organisation	KMD Computer Centre
Position	Instructor – Asst lecturer
Duration	2007 – 2010

### Teaching Experience

Position	Info Myanmar College
Modules	NT, NOS, ISM, RC, NI, WAN, Networking.
Level	HND Diploma, Pearson Education
Position	IMCS Training Centre
Modules	Service + Engineering
Level	Certificate Level
Position	KMD Computer Centre
Modules	Network Engineering Course
Level	Certificate Level
Position	KMD Computer Centre
Modules	Basic Computer system/Practical A+/ Practical N+
Level	Certificate Level





## Info Myanmar University



**Daw Wai Wai Hnin**  
Instructor

### Personal Details

Address	: U Chit Maung St, Bahan Tsp; Yangon
Contact Phone	: +95 – 01 - 512119
Email	: floatsnow8@gmail.com
Date of Birth	: 15 March 1995

### Educations and Qualifications

Title	: Computer Basic
Awarding Organisation	: HI-TECH
Duration	: 2011
Title	: B-Tech (EC)
Awarding Organisation	: Technology University (Kyaukse)
Duration	: 2016
Title	: BE-EC
Awarding Organisation	: Technology University (Kyaukse)
Duration	: 2017
Title	: Service +Engineering
Awarding Organisation	: IMCS
Duration	: 2017
Title	: CCNA
Awarding Organisation	: IMCS
Duration	: 2018

### Industrial and Commercial Experience

Name of Organisation	: Info Myanmar College
Position	: Instructor
Duration	: April 2017- Present



## Info Myanmar University



**Daw Chaw Su Mon**

**Lecturer**

### Personal Details

Address	: 1075, Phayar Street, 7 West Quarter, Tharketa Township. Yangon
Contact Phone	: +95-01-512119
Email	: mon.chawsu@gmail.com
Date of Birth	: 14 August 1982

### Educations and Qualifications

Title	:B.C.Sc
Awarding Organisation	:Universities of Computer Studies(Yangon)
Duration	:2000- 2003
Title	:Oracle Certified Professional, Java SE6 Programmer
Awarding Organisation	:Oracle University
Duration	:June 2016
Title	:Teaching English to Speakers of Other Language (TESOL)
Awarding Organisation	:TESOL International Association
Duration	:2015

### Industrial and Commercial Experience

Name of Organisation	Info Myanmar College
Position	Lecturer
Duration	Dec 2015 - Present
Name of Organisation	Myanmar Noble College
Position	Teacher
Duration	June 2012 – Dec 2015
Name of Organisation	Winner Computer Group
Position	Instructor
Duration	June 2004 – June 2012



## Teaching Experience

Position Modules  Level	Lecturer at Info Myanmar College Data Structure and Algorithms, Information Systems in Organisations, Object Oriented Programming, Database Analysis and Design, Programming in Java, Programming, Database Design and Concepts, Systems Analysis and Design, Website Design Higher National Diploma (QCF, RQF)
Position Modules  Level	Myanmar Noble College Data Structure and Algorithms, Information Systems, Database Design and Concepts, Systems Analysis and Design, Project Design Implementation and Evaluation Higher National Diploma (QCF)
Position Modules Level	Winner Computer Group MS Application, C++, VBA, Group Project(Supervisor) Post Graduate Diploma in Computer Application (ULB in Yangon University)
Position Modules Level	Winner Computer Group Data Structures in programming with C++ Under Graduate Diploma (SE,NE,HE) (RC-Botahtaung Campus)
Position Modules Level	Winner Computer Group & Yoma Technologies J2SE Under graduate/ Post graduate students/ job training (DCR Myanmar)

## Membership of Professional bodies/institutions

Student Member, MCPA



## Info Myanmar College



**Daw Khin Thet Wai Han**

**Demonstrator**

### Personal Details

Address	: Building (1), Room (4), Badonmar Street, No (95), Township, Yangon.
Contact Phone	: +95-01-512119
Email	: khinthewaihan2@gmail.com
Date of Birth	: 2 October 1993

### Educations and Qualifications

Title	: B.Sc.(Hons) Business IT
Awarding Organisation	: University of Greenwich, UK
Duration	: 2012 to 2013
Title	: IADCS
Awarding Organisation	: NCC Education, UK
Duration	: 2011 to 2012
Title	: IDCS International Diploma in Computer Studies
Awarding Organisation	: NCC Education, UK
Duration	: 2010 to 2011
Title	: Service+ Engineering Certificate
Awarding Organisation	: IMCS Training Centre of Yangon
Duration	: Mar 2017
Title	: Microsoft Certified Solutions Associate (MCSA)
Awarding Organisation	: IMCS Training Centre of Yangon
Duration	: 2016 to 2017
Title	: ITIL Foundation Course
Awarding Organisation	: MCIA (Yangon Region Computer Industry Association)
Duration	: Sep 2017





### Industrial and Commercial Experience

Name of Organisation	: Info Myanmar College
Position	: Assistant Lecturer
Duration	: 2019 - Present
Name of Organisation	: MCC Company of Yangon
Position	: Junior Software Engineer
Duration	: 2014-2016
Name of Organisation	: RITZ Public Company
Position	: IT Help Desk Agent at RITZ
Duration	: 2017
Name of Organisation	: RITZ Public Company
Position	: Network Engineer of Infra Team
Duration	: 2017 to 2018

### Teaching Experience


Position	Demonstrator at Info Myanmar College
Modules	1. Database Design and Development 2. Programming Language
Level	Higher National Diploma, Pearson Education

### Membership of Professional bodies/institutions

MCIA Yangon Region Computer Industry Association



## Info Myanmar University

	<b>Daw Zin Mar Win</b>  <b>Officer</b>
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### Personal Details

Address	: Room (1-2)Shin Saw Pu Road, Ahlone Tsp; Yangon
Contact Phone	: +95 – 01 - 512119
Email	: zinmarwin312@gmail.com
Date of Birth	: 3 April 1990

### Educations and Qualifications

Title	: B.E (IT)
Awarding Organisation	: West Yangon Technological University
Duration	: 2007-2011

### Industrial and Commercial Experience

Name of Organisation	: MCC
Position	: Class Tutor
Duration	: June 2012 to- Oct 2015
Name of Organisation	: Info Myanmar College
Position	: Student Service Staff
Duration	: 2015-2018
Name of Organisation	: Info Myanmar College
Position	: Student Service Officer
Duration	: 2018 - Present



## Info Myanmar University



**Daw Swe Zin Phyo**

**Student Service**

### Personal Details

Address	: No.B, Sabal 2 <sup>nd</sup> St, Kamayut, Yangon
Contact Phone	: +95 – 01 - 512119
Email	: -
Date of Birth	: 18 August1992

### Educations and Qualifications

Title	: First Year ( History)
Awarding Organisation	: Dagon University
Duration	: -

### Industrial and Commercial Experience

Name of Organisation	: Info Myanmar College
Position	: Operation Staff
Duration	: 2017 – Present



## Info Myanmar University



**Daw Aye Sandar Kyaw**

**Student Service**

### Personal Details

Address	: Room(57), 18 Building, Pyi Yeik Mon(7) Ward, Narnat Taw St, Kamayut Tsp; Yangon
Contact Phone	: +95 – 01 - 512119
Email	: -
Date of Birth	: 21 March 1999

### Educations and Qualifications

Title	: Final Year (English)
Awarding Organisation	: Dagon University
Duration	: 2019

### Industrial and Commercial Experience

Name of Organisation	: Info Myanmar College
Position	: Operation Staff
Duration	: 2018 - Present





## Info Myanmar University



**Daw Phyu Phyu Thin**

**Student Service**

### Personal Details

Address	: No.48/50, 22 <sup>nd</sup> St, (13) Quarter, Hlaing Tsp;
Contact Phone	: +95 – 01 - 512119
Email	: PhyuPhyuthin 688@gmail.com
Date of Birth	: 21 May 1996

### Educations and Qualifications

Title	: B.A (Eom)
Awarding Organisation	: Pyay University
Duration	: 2019

### Industrial and Commercial Experience

Name of Organisation	: Info Myanmar College
Position	: IT Staff
Duration	: 2018 - Present



## Info Myanmar University



**Daw Thae Thae Aung**

**Student Service**

### Personal Details

Address	: No.3 Ward, 4 <sup>th</sup> floor, Htantapin St, Kamayut, Yangon
Contact Phone	: +95 – 01 - 512119
Email	: -
Date of Birth	: 17 September 1993

### Educations and Qualifications

Title	: B.Sc (Chemistry)
Awarding Organisation	: Pyay University
Duration	: -

### Industrial and Commercial Experience

Name of Organisation	: Info Myanmar College
Position	: Operation Staff
Duration	: 2018 - Present



## Info Myanmar University



**Daw Pa Pa Win**

**Student Service**

### Personal Details

Address	: No.15, Htantapin St, Hledan Kamayut Tsp, Yangon
Contact Phone	: +95 – 01 - 512119
Email	: papawinr26@gmail.com
Date of Birth	: 17 December 1995

### Educations and Qualifications


Title	: B.A (Geography)
Awarding Organisation	: Shwe Bo University
Duration	: 2017-2018

### Industrial and Commercial Experience

Name of Organisation	: Nice Day Hotel
Position	: Receptionist & Office Staff
Duration	: January 2018 to June 2018
Name of Organisation	: Info Myanmar College
Position	: Operation Staff
Duration	: 2018 - Present



## Info Myanmar University

	<b>Daw Tha Zin Htun</b>  <b>Student Service</b>
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### Personal Details

Address	: No.14, 3 <sup>rd</sup> Floor, Hledan 1 <sup>st</sup> St, Kamayut
Contact Phone	: +95 – 01 - 512119
Email	: thazinhtuntracy@gmail.com
Date of Birth	: 17 September 1993

### Educations and Qualifications

Title	: B.Sc (History)
Awarding Organisation	: Pathein University
Duration	: 2009
Title	: i office(advanced)
Awarding Organisation	: KMD Computer Centre
Duration	: -
Title	: Excel in B.A
Awarding Organisation	: KMD Computer Centre
Duration	: -
Title	: Layout Design
Awarding Organisation	: KMD Computer Centre
Duration	: -

### Industrial and Commercial Experience

Name of Organisation	: Info Myanmar College
Position	: IT Staff
Duration	: 2019 - Present





## Info Myanmar University



**Daw Htet Htet Moe**

**IT Staff**

### Personal Details

Address	: 9/B, Thukha St, 6 <sup>th</sup> Quarter, Hlaing Tsp; Yangon
Contact Phone	: +95 – 01 - 512119
Email	: htethtetmoecu@gmail.com
Date of Birth	: 27 July 1997

### Educations and Qualifications


Title	: B.C.Sc.
Awarding Organisation	: Computer University (Pakokku)
Duration	: 2019

### Industrial and Commercial Experience

Name of Organisation	: Info Myanmar College
Position	: IT Staff
Duration	: 2019-Present



## Info Myanmar University

	<b>Daw Hnin Hnin Phyu</b>  <b>IT Staff</b>
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### Personal Details

Address	: No(150), Ground floor, 47 St, Botachtaung Tsp; Yangon
Contact Phone	: +95 – 01 - 512119
Email	: mahninhninphyu31@gmail.com
Date of Birth	: 31 October 1992

### Educations and Qualifications

Title	: B.A (English)
Awarding Organisation	: University of East Yangon
Duration	: 2013
Title	: Diploma in IT
Awarding Organisation	: KMD
Duration	: -
Title	: Higher Diploma in Business Management
Awarding Organisation	: Co-operative University and Wise College
Duration	: 2015

### Industrial and Commercial Experience

Name of Organisation	: Myanmar Apex Bank
Position	: Senior Associate
Duration	: 2013-2017
Name of Organisation	: Myanmar Insurance Association Computer Operator
Position	: Computer Operator
Duration	: 2017-2018
Name of Organisation	: Info Myanmar College
Position	: IT Staff
Duration	: 2019 - Present



## Info Myanmar University



**U Paw Tun**

**Assistant Engineer**

### Personal Details

Address	: 24A, 6 <sup>th</sup> floor, Khaing Shwe War St, Kamayut,
Contact Phone	: +95 – 01 - 512119
Email	: pawtun 94@gmail.com
Date of Birth	: 9 April 1994

### Educations and Qualifications


Title	: AGTI
Awarding Organisation	: Kyauk Pa Daung Institute
Duration	: 2011-2013
Title	: B-Tech
Awarding Organisation	: Meiktila University (TU)
Duration	: 2013-2015

### Industrial and Commercial Experience

Name of Organisation	: Naypyitaw
Position	: Private
Duration	: 2015-2016
Name of Organisation	: ISM
Position	: M&E Engineer
Duration	: August 2016 to October 2016
Name of Organisation	: Golden Asia
Position	: M&E Engineer
Duration	: November 2016 to April 2017
Name of Organisation	: Info Myanmar College
Position	: Assistant Engineer
Duration	: 2017-Present



## Info Myanmar University

	<p><b>U Thet Naing Aung</b></p> <p><b>Technical Assistant</b></p>
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### Personal Details

Address	: 6 <sup>th</sup> floor(A), 50 St, Hladen, Kamayut Tsp,
Contact Phone	: +95 – 01 - 512119
Email	: -
Date of Birth	: 22 May 1998

### Educations and Qualifications

Title	: Second Year (History)
Awarding Organisation	: Hinthada University
Duration	: -


### Industrial and Commercial Experience

Name of Organisation	: Info Myanmar College
Position	: Technical Assistant
Duration	: 2016-Present





## Info Myanmar University

	<p><b>U Zaw Min Lwin</b></p> <p><b>IT Support Incharge</b></p>
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### Personal Details

Address	: No.80/A, Room (25), 8 <sup>th</sup> floor, sizone St, Sanchaung Tsp, Yangon
Contact Phone	: +95 – 01 - 512119
Email	: minlwinnay@gmail.com
Date of Birth	: 3 April 1984

### Educations and Qualifications


Title	: B.A (Ecom)
Awarding Organisation	: Mandalay
Duration	: 2006
Title	: A+ Hardware & NE
Awarding Organisation	: Youth Computer Centre
Duration	: 2010
Title	: Diploma in IT
Awarding Organisation	: NMC (KMD)
Duration	: 2011-2012
Title	: Networking Linux Server Based
Awarding Organisation	: Y-Max
Duration	: 2016
Title	: Basic Wireless Networking
Awarding Organisation	: MCPA (Yangon)
Duration	: 2017
Title	: English (4 Skills)
Awarding Organisation	: TOP HR Solution
Duration	: 2017



Industrial and Commercial Experience	
Name of Organisation	: CYSTEM Computer, Samsung IT
Position	: Sales & Service
Duration	: March 2011 to March 2012
Name of Organisation	: Consumer Company
Position	: Senior IT Staff
Duration	: April 2013 to January 2015
Name of Organisation	: Imperial Channel
Position	: IT Assistant & ADSL Engineer
Duration	: February 2015 to June 2017
Name of Organisation	: Info Myanmar College
Position	: IT Support (Incharge)
Duration	: 2017 - Present



## Info Myanmar University

	<p><b>U Aung Moe Myint</b></p> <p><b>Lab Department</b></p>
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### Personal Details

Address	: Pyi Yeik Thar St, Hledan, Kamayut
Contact Phone	: +95 – 01 - 512119
Email	: amm 2016imcs@gmail.com
Date of Birth	: 5 September 1999

### Educations and Qualifications

Title	: Service+ Engineering
Awarding Organisation	: IMCS
Duration	: 2016
Title	: CSCU
Awarding Organisation	: IMCS
Duration	: 2016
Title	: First Year (Geography)
Awarding Organisation	: Hinthada University
Duration	: 2016-2018

### Industrial and Commercial Experience

Name of Organisation	: Info Myanmar College
Position	: IT Support
Duration	: 2016 - Present



## Info Myanmar University

	<b>U Zayar Lin Oo</b>  <b>IT Support</b>
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### Personal Details

Address	: No(10), Kyar Taw Ra St, Bahan Tsp;
Contact Phone	: +95 – 01 - 512119
Email	: zayarlinnoo1998@gmail.com
Date of Birth	: 4 August 1998

### Educations and Qualifications

Title	: Third Year (Myanmar)
Awarding Organisation	: East University Yangon
Duration	: 2016-2018
Title	: Graphic Design
Awarding Organisation	: KLC
Duration	: 2017
Title	: Basic Computer, Advanced excel
Awarding Organisation	: KLC
Duration	: 2017
Title	: CSCU(certified Secure computer user)
Awarding Organisation	: IMCS
Duration	: 2018
Title	: A+ Hardware & CCNA
Awarding Organisation	: IMCS
Duration	: 2018


### Industrial and Commercial Experience

Name of Organisation	: Info Myanmar College
Position	: IT support
Duration	: September 2018





## Info Myanmar University

	<b>U Kyaw Zin Phyo</b>  <b>Lab Department</b>
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### Personal Details

Address	: No.10/B, Da Nya Waty St, Makyiky Road, Sanchaung Tsp;
Contact Phone	: +95 – 01 - 512119
Email	: kyawzinphyoe.bc2016@gmail.com
Date of Birth	: 1 April 1996

### Educations and Qualifications

Title	: B.A (Phil)
Awarding Organisation	: Shwe Bo University
Duration	: 2013-2018
Title	: Service+ Engineering
Awarding Organisation	: IMCS
Duration	: 2017
Title	: CSCU
Awarding Organisation	: IMCS
Duration	: 2017

### Industrial and Commercial Experience

Name of Organisation	: Info Myanmar College
Position	: IT support
Duration	: December 2018 – Present



## Info Myanmar University



**U Min Min Soe**

**Lab Department**

### Personal Details

Address	: No (8), 15, Pyi Yeik Mon Ward, Hledan, Kamyut Tsp; Yangon
Contact Phone	: +95 – 01 - 512119
Email	: fancyboylay2@gmail.com
Date of Birth	: 25 June 1995

### Educations and Qualifications

Title	: B.C Tech
Awarding Organisation	: Monywa Computer University
Duration	: 2016
Title	: Service+ Engineering
Awarding Organisation	: IMCS
Duration	: 2016
Title	: CCNA
Awarding Organisation	: IMCS
Duration	: 2018

### Industrial and Commercial Experience

Name of Organisation	: Info Myanmar College
Position	: Instructor
Duration	: October 2016 - Present



## Info Myanmar University



**U Saw Htet**

**Cameraman**

### Personal Details

Address	: No(468), 7 <sup>th</sup> St, Taguaung, South Okkalapa Tsp;
Contact Phone	: +95 – 01 - 512119
Email	: mgsawhtet2015@gmail.com
Date of Birth	: 20 November 1990

### Educations and Qualifications

Title	: B.A (Ecom)
Awarding Organisation	: Dagon University
Duration	: 2011

### Industrial and Commercial Experience

Name of Organisation	: Forever Group Co.,Ltd
Position	: Cameraman
Duration	: 2016
Name of Organisation	: 5-Plus
Position	: Cameraman
Duration	: 2017
Name of Organisation	: Cherry FM Web Tv
Position	: Cameraman
Duration	: 2018
Name of Organisation	: Info Myanmar College
Position	: Cameraman
Duration	: 2018-Present



## Info Myanmar University



**U Sai Maung Maung Aye**

**Graphic Designer**

### Personal Details

Address	: -
Contact Phone	: +95 – 01 - 512119
Email	: freedomway.St@gmail.com
Date of Birth	: 22 January 1989

### Educations and Qualifications

Title	: First Year (Myanmar)
Awarding Organisation	: Lashio University
Duration	: 2010


### Industrial and Commercial Experience

Name of Organisation	: Health for All Magazine
Position	: Graphic Designer
Duration	: 2013-2015
Name of Organisation	: ပြည်သူ့ဆန္ဒရှာနယ်
Position	: Graphic Designer
Duration	: 2015-2016
Name of Organisation	: Fortune Media Group
Position	: Graphic Designer
Duration	: 2016
Name of Organisation	: Zay Kabar Co.,Ltd
Position	: Graphic Designer
Duration	: 2016-2018
Name of Organisation	: Info Myanmar College
Position	: Graphic Designer & Video Editor
Duration	: 2018-Present





## Info Myanmar University

	<b>Daw Hnin Wint Soe</b>  <b>Executive Officer</b>
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### Personal Details

Address	: Building 198, 6 <sup>th</sup> Floor/B Kunchan 3 <sup>rd</sup> St, Hledan, Kamayut Tsp; Yangon
Contact Phone	: +95 – 01 - 512119
Email	: hninwintsoe86@gmail.com
Date of Birth	: 13 September 1986

### Educations and Qualifications

Title	: Third Year
Awarding Organisation	: Hinthada University
Duration	: -

### Industrial and Commercial Experience

Name of Organisation	: Victoria Shopping Mall
Position	: Supervisor
Duration	: 2007-2013
Name of Organisation	: Info Myanmar College
Position	: Marketing Supervisor
Duration	: 2010-2011
Name of Organisation	: City Mart
Position	: Sales Staff
Duration	: 2013-2014



## Info Myanmar University



**Daw Yee Mon Thin**

**Marketing**

### Personal Details

Address	: No. 47, Thirimyaing 3 <sup>rd</sup> St, (13) Ward, Hlaing Tsp; Yangon
Contact Phone	: +95 – 01 - 512119
Email	: blackrose2013@gmail.com
Date of Birth	: 5 June 1991

### Educations and Qualifications

Title	: Final Year (Law)
Awarding Organisation	: Dagon University
Duration	: 2018-2019

### Industrial and Commercial Experience

Name of Organisation	: Bio Plus
Position	: Sales & Marketing
Duration	: 2009-2010
Name of Organisation	: Sein Gay Har
Position	: Audit
Duration	: 2010-2011
Name of Organisation	: Unilever (Pond's)
Position	: Sales & Marketing
Duration	: 2012-2013
Name of Organisation	: City Mart
Position	: Sales Staff
Duration	: 2013-2014
Name of Organisation	: Info Myanmar College
Position	: Office Staff
Duration	: 2016-2018



Name of Organisation	: Info Myanmar College
Position	: Supervisor
Duration	: 2018 - Present



## Info Myanmar University



**Daw May Mon Oo**

**Junior Accountant**

### Personal Details

Address	: No.79, Building 15, Pyi Yeik Mon, Kamayut
Contact Phone	: +95 – 01 - 512119
Email	:-
Date of Birth	: 14 June 1995

### Educations and Qualifications

Title	: B.Eon (Eco)
Awarding Organisation	: Economic of Meikhtila University
Duration	: 2015-2016

### Industrial and Commercial Experience

Name of Organisation	: Info Myanmar College
Position	: Junior Accountant
Duration	: 2017-Present





## Info Myanmar University



**Daw Myat Thinzar Soe**  
**Junior Accountant**

### Personal Details

Address	: No (32), U Tun Lin Chan St, Hledan, Kamayut
Contact Phone	: +95 – 01 - 512119
Email	: myatthinzarsoe865@gmail.com
Date of Birth	: 5 August 1993

### Educations and Qualifications


Title	: B.Sc(Chemistry)
Awarding Organisation	: Dawei University
Duration	: 2016
Title	: Diploma in Accounting & Finance
Awarding Organisation	: U Nay Lin Aung
Duration	: 2017
Title	: Diploma in Accounting & Business
Awarding Organisation	: U Nay Lin Aung
Duration	: 2017

### Industrial and Commercial Experience

Name of Organisation	: Info Myanmar College
Position	: Junior Accountant
Duration	: February 2019-Present



## Info Myanmar University

	<p><b>U Nay Va La</b></p> <p><b>Auditor</b></p>
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Personal Details	
Address	: BOC bus-stop, Seik Kan Thar Road, Hlaing Tharyar Tsp; Yangon
Contact Phone	: +95 – 01 - 512119
Email	: tunshinethu111@gmail.com
Date of Birth	: 5 November 1994

Educations and Qualifications	
Title Awarding Organisation Duration	: Volunteer : American Center : 2015
Title Awarding Organisation Duration	: LCCI Level-1,2 : Mee (Hlaing Tharyar) : 2015
Title Awarding Organisation Duration	: LCCI Level-3 : Yar Pyae : 2016
Title Awarding Organisation Duration	: Quick Book Accounting Software : Daw Thida Oo : 2016
Title Awarding Organisation Duration	: B.A (History) : University of West Yangon : 2018
Title Awarding Organisation Duration	: Elementary to Pre-intermediate part-1 : Active English : 2018



Industrial and Commercial Experience	
Name of Organisation	: Advantis kusahara Sedaate Myanmar (PVE) Ltd
Position	: Inventory: Documentation Accountant Supervisor
Duration	: 2014-2016
Name of Organisation	: Account Sineerece Co.,Ltd
Position	: Account: Internal Auditor
Duration	: April 2016 to March 2017
Name of Organisation	: Account (NCX)
Position	: Internal Auditor
Duration	: April 2017 to October 2018
Name of Organisation	: Info Myanmar College
Position	: Auditor
Duration	: January 2019 to Present



## Info Myanmar University



**Daw Yu Yu Kyaw**

**Storekeeper**

### Personal Details

Address	: No.78, Myawddy Mingyi 3 <sup>rd</sup> St, Shwe Pauk Kan, North Okkalapa, Yangon
Contact Phone	: +95 – 01 - 512119
Email	:-
Date of Birth	: 27 February 1980

### Educations and Qualifications

Title	: B.Sc (Botany)
Awarding Organisation	: East Yangon University
Duration	: -
Title	: Computer (Basic)
Awarding Organisation	: KLC
Duration	: -
Title	: Booking & Accounting
Awarding Organisation	: KLC
Duration	: -





Industrial and Commercial Experience	
Name of Organisation	: Crown Soe Myint
Position	: Storekeeper
Duration	: 2006-2008
Name of Organisation	: Kyin Lone
Position	: Storekeeper
Duration	: 2008-2012
Name of Organisation	: Bang Bang Apperal
Position	: Store Account
Duration	: 2012-2015
Name of Organisation	: Grand Sport
Position	: Office Staff
Duration	: 2015-2017
Name of Organisation	: M.G
Position	: Office Staff
Duration	: Oct 2017-Nov 2017
Name of Organisation	: Info Myanmar College
Position	: Storekeeper
Duration	: 2018- Present



## Info Myanmar University



**U Thet Tun Zaw**  
**Admin Assistant**

### Personal Details

Address	: Building 15, 4 <sup>th</sup> Floor, Sinyaythwin 1 <sup>st</sup> St, Kamayut Tsp; Yangon
Contact Phone	: +95 – 01 - 512119
Email	: tz.tunZaw732@gmail.com
Date of Birth	: 29 April 1991

### Educations and Qualifications

Title	: B.A (Myanmar)
Awarding Organisation	: Dagon University
Duration	: -

### Industrial and Commercial Experience

Name of Organisation	: IMCS
Position	: Admin Assistant
Duration	: 2007-2019
Name of Organisation	: Info Myanmar College
Position	: Admin Assistant
Duration	: 2019 - Present



## Info Myanmar University



**Daw Ohinmar**

**HR Executive**

### Personal Details

Address	: No(10), 1 <sup>st</sup> Quarter, Thamine, Mayangon Tsp; Yangon
Contact Phone	: +95 – 01 - 512119
Email	: maoninmar@gmail.com
Date of Birth	: 19 July 1981

### Educations and Qualifications

Title	: B.Sc (Maths)
Awarding Organisation	: Mandalay University
Duration	: 2001-2003

### Industrial and Commercial Experience

Name of Organisation	: City Mart Holding Co., Ltd
Position	: HR Officer
Duration	: 2004-2013
Name of Organisation	: Kaung Htet (Myanmar) Co., Ltd
Position	: HR Executive
Duration	: 2013-2014
Name of Organisation	: 21 <sup>st</sup> Security Dragon Co., Ltd
Position	: HR Manager
Duration	: 2014-2015
Name of Organisation	: Grand Wynn Group of Company
Position	: Admin & HR Manager
Duration	: 2016-2017
Name of Organisation	: Info Myanmar College
Position	: HR Executive
Duration	: July 2018 to Present

## Salary List

No	Name	Department	Initial Pay	Deduction		Total	Allowance	Net Pay
				Leave & Late	Fine			
အကြံပေးအဖွဲ့								
1	U Myo Min							
2	Dr. San San Mon							
3	Dr. Myat Thandar Khin							
သင်ကြားရေး ဝန်ထမ်းများ								
1	Dr. Myat Thandar Khin	CS & T	500,000			500,000	200,000	700,000
2	Dr. Ngu Wah Win	CS & T	500,000			500,000	200,000	700,000
3	Dr.Nyo Nyo Htwe	CS & T	500,000			500,000	200,000	700,000
4	Dr. Ingyin Khaing	CS & T	500,000			500,000	200,000	700,000
5	Dr.May Thu Aung	Software	500,000			500,000	200,000	700,000
6	Dr. Aye Aye Myint	Software	500,000			500,000	200,000	700,000
7	Dr. Nu War Hsan	Software	500,000			500,000	200,000	700,000
8	Dr.Aye Mya Thandar	Software	500,000			500,000	200,000	700,000
9	U Tun Aung(2)	CS & T	400,000			400,000	150,000	550,000
10	Daw Hnin Pwint Phyu	CS & T	400,000			400,000	150,000	550,000
11	Dr. San San Mon	Maths	400,000			400,000	150,000	550,000
12	Daw Kay Thwe Hline	Maths	400,000			400,000	100,000	500,000
13	Daw Hnin Wai Wai Hlaing	Software	400,000			400,000	100,000	500,000
14	Daw Thida Lwin	Software	400,000			400,000	100,000	500,000
15	Daw May Soe Htay	Software	400,000			400,000	100,000	500,000
16	Daw Ohnma Khine	Maths	400,000			400,000	100,000	500,000
17	U Kaung Dana Htet	CS & T	300,000			300,000	150,000	450,000
18	U Hein Min Aung	CS & T	300,000			300,000	150,000	450,000
19	U Tun Aung (1)	CS & T	300,000			300,000	150,000	450,000
20	Daw Hnin Ei Phyu	CS & T	300,000			300,000	150,000	450,000
21	Daw Zin Mar Tun	CS & T	300,000			300,000	150,000	450,000
22	Daw Hay Mar Lwin	CS & T	300,000			300,000	150,000	450,000
23	U Tin Htoo Zaw	CS & T	300,000			300,000	150,000	450,000
24	U Naing Min Aung	CS & T	300,000			300,000	150,000	450,000
25	U Tun Aung Thein	CS & T	300,000			300,000	150,000	450,000
26	Daw Wai Wai Hnin	CS & T	300,000			300,000	150,000	450,000
27	Daw Thi Thi Thandar Saw Htay	CS & T	300,000			300,000	150,000	450,000
28	Daw Mya Kay Thwe Tun	English	300,000			300,000	150,000	450,000



No	Name	Department	Initial Pay	Deduction		Total	Allowance	Net Pay
				Leave & Late	Fine			
29	U Chan Thar Soe	English	300,000			300,000	150,000	450,000
30	Daw Chaw Su Mon	Software	300,000			300,000	100,000	400,000
31	Daw Thinzar Soe	Software	300,000			300,000	100,000	400,000
32	Daw Hnin Yi San	Software	300,000			300,000	100,000	400,000
33	Daw Saint Saint San	Software	300,000			300,000	100,000	400,000
34	Daw Nandar Moh Moh Lwin	Software	300,000			300,000	100,000	400,000
35	Daw Tin Nilar Win	Software	300,000			300,000	100,000	400,000
36	Daw Khin Thet Wai Han	Software	200,000			200,000	50,000	250,000
စီမံခန့်ခွဲရေးနှင့် အခြားအဆင့်ဝန်ထမ်းများ								
1	Dr. Tin Tin Aye	Student Service	500,000			500,000	200,000	700,000
2	Daw Yin Yin Min	Student Service	400,000			400,000	150,000	550,000
3	Daw Zin Mar Win	Student Service	300,000			300,000	100,000	400,000
4	Daw Myint Myint Moe	Student Service	150,000			150,000	100,000	250,000
5	Daw Swe Zin Phyo	Student Service	200,000			200,000	20,000	220,000
6	Daw Aye Sandar Kyaw	Student Service	200,000			200,000	20,000	220,000
7	Daw Phyu Phyu Thin	Student Service	200,000			200,000	20,000	220,000
8	Daw Thae Thae Aung	Student Service	200,000			200,000	20,000	220,000
9	Daw Pa Pa Win	Student Service	200,000			200,000	20,000	220,000
10	Daw Tha Zin Htun	Student Service	200,000			200,000	0	200,000
11	Daw Htet Htet Moe	Student Service	200,000			200,000	0	200,000
12	Daw Hnin Hnin Phyu	Student Service	200,000			200,000	0	200,000
13	U Han Win Aung	M&E	300,000			300,000	100,000	400,000
14	U Paw Tun	M&E	200,000			200,000	50,000	250,000
15	U Thet Naing Aung	M&E	200,000			200,000	25,000	225,000
16	U Myo Win Zaw	M&E	200,000			200,000	0	200,000
17	U Naung Naung	M&E	200,000			200,000	0	200,000
18	U Chit Kaung	M&E	145,000			145,000	0	145,000
19	U Kaung Wai Tun	M&E	145,000			145,000	0	145,000
20	U Zaw Min Lwin	LAB	250,000			250,000	50,000	300,000
21	U Aung Moe Myint	LAB	200,000			200,000	20,000	220,000
22	U Zayar Lin Oo	LAB	200,000			200,000	20,000	220,000
23	U Kyaw Zin Phyo	LAB	200,000			200,000	20,000	220,000
24	U Min Min Soe	LAB	200,000			200,000	20,000	220,000
25	U Saw Htet	Media	300,000			300,000	100,000	400,000

No	Name	Department	Initial Pay	Deduction		Total	Allowance	Net Pay
				Leave & Late	Fine			
26	U Sai Mg Mg Aye @ Sai Thura	Media	200,000			200,000	150,000	350,000
27	U Paing Min Htut	Media	150,000			150,000	0	150,000
28	Daw Hnin Wint Soe	Marketing	200,000			200,000	100,000	300,000
29	Daw Yee Mon Thin	Marketing	150,000			150,000	50,000	200,000
30	Daw Kay Khaing Win	Finance	200,000			200,000	150,000	350,000
31	Daw May Mon Oo	Finance	150,000			150,000	100,000	250,000
32	Daw Myat Thinzar Soe	Finance	150,000			150,000	100,000	250,000
33	U Nay Va La	Finance	150,000			150,000	100,000	250,000
34	Daw Yu Yu Kyaw	Store	150,000			150,000	100,000	250,000
35	Daw Nwe Nwe Oo	Admin	500,000			500,000	200,000	700,000
36	Daw Khin Kyu	Admin	400,000			400,000	100,000	500,000
37	Daw Khin Win Lei Phyu	Admin	300,000			300,000	150,000	450,000
38	Daw Amy	Admin	200,000			200,000	100,000	300,000
39	U Thet Tun Zaw	Admin	150,000			150,000	50,000	200,000
40	Daw Htet Htet Zin	Admin	150,000			150,000	0	150,000
41	Daw Khin Thin Myat Mon	Admin	200,000			200,000	100,000	300,000
42	U Nan Oo	Driver	200,000			200,000	50,000	250,000
43	U Soe Pyae Sone	Driver	150,000			150,000	0	150,000
44	Daw San Myint	Cleaner	145,000			145,000	20,000	165,000
45	Daw San Oo	Cleaner	145,000			145,000	10,000	155,000
46	Daw San San	Cleaner	145,000			145,000	10,000	155,000
47	Daw Nwe Nwe	Cleaner	145,000			145,000	10,000	155,000
48	Daw Lei Lei Myint	Cleaner	145,000			145,000	10,000	155,000
49	Daw Zin Mar Myo	Cleaner	145,000			145,000	10,000	155,000
50	Daw San San Oo	Cleaner	145,000			145,000	10,000	155,000
51	Daw Aye Mon San	Cleaner	145,000			145,000	10,000	155,000
52	Daw Ohinma	HR	200,000			200,000	150,000	350,000
Total			21,490,000	-	-	21,490,000	7,505,000	28,995,000



**Info Myanmar University (IMU)**

ပုဂ္ဂလိက ကျောင်းဆရာ၊ဆရာမများ နှင့်  
စီမံခန့်ခွဲရေး ဝန်ထမ်းများ လုံလောက်မှုရှိကြောင်း  
ဝန်ခံကတိ



သို့.

ဥက္ကဋ္ဌ

မြန်မာနိုင်ငံ ရင်းနှီးမြှုပ်နှံမှုကော်မရှင်

ရန်ကုန်မြို့။

စာအမှတ် ။ ။ IMC/Admin/2019(177)

ရက်စွဲ ။ ။ ၂၀၁၉ ခုနှစ်၊ မေလ၊ ၉ရက်။

အကြောင်းအရာ။

။ ပုဂ္ဂလိကကျောင်းဆရာ၊ဆရာမများ နှင့် စီမံခန့်ခွဲရေး ဝန်ထမ်းများ လုံလောက်မှု  
ရှိကြောင်း ဝန်ခံကတိပြုခြင်း။

အထက်အကြောင်းအရာပါကိစ္စနှင့်စပ်လျဉ်း၍ ကျွန်ုပ်တို့၏ IMCS (Institute of Management & Computer Studies) Company Limited ၊ ကုမ္ပဏီ မှတ်ပုံတင်အမှတ် (103990572)သည် ဝန်ဆောင်မှုလုပ်ငန်း အမျိုးအစားဆောင်ရွက်လုပ်ကိုင်ခွင့်ရရှိပြီး Info Myanmar College တည်ထောင်ကာ ပညာရေးဝန်ဆောင်မှု လုပ်ငန်းများကို စဉ်ဆက်မပြတ် ဆောင်ရွက်လျက်ရှိရာ Info Myanmar University အဖြစ် ပညာရေး ဝန်ဆောင်မှုများ လုပ်ဆောင်ပါက ပညာသင်ကြားပို့ချမည့် သင်ကြားရေး ဆရာ၊ဆရာမများ နှင့် စီမံခန့်ခွဲရေး ဝန်ထမ်းများ လုံလောက်စွာဖြင့် သင်ကြားပို့ချမှုများဆောင်ရွက်မည်ဖြစ်ပါကြောင်းဝန်ခံကတိပြုအပ်ပါသည်။

လေးစားစွာဖြင့်

နနသန့်

Founder & Managing Director

IMCS Co., Ltd.





**Info Myanmar University (IMU)**

ပေးအပ်မည့် သင်တန်းဆင်းလက်မှတ်၊  
အောင်လက်မှတ် နှင့် ဒီပလိုမာ၊ ဘွဲ့လက်မှတ်  
အမျိုးအစားများနှင့် အသိအမှတ်ပြုသည့်  
အဖွဲ့အစည်း



TO WHOM IT MAY CONCERN

Naomi Graham  
Vice Principal International  
Sighthill Campus  
9-11 Sighthill Court  
Edinburgh  
EH11 4BN

t +44 (0)131 455 3209  
e n.graham@napier.ac.uk

5 April 2019

Dear Sirs

**INFO MYANMAR COLLEGE**

I hereby confirm that Info Myanmar College are an approved Partner of Edinburgh Napier University.

In 2017, the Court of Edinburgh Napier University entered into a formal Collaboration Agreement with Info Myanmar College to offer the BSc Computing programme in Myanmar. This Agreement was extended in 2019 to offer the BSc (Honours) Computing, and is valid for intakes up to 2021.

Yours faithfully

Naomi Graham  
Vice Principal International



**BTEC**  
**Approved Centre**  
**Certificate**

This is to certify that

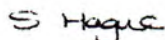
**IMCS - INFO MYANMAR COLLEGE**

is approved to offer: BTEC Qualifications

**Centre Number: 95921**

Issued on: 01 January 2016

Valid until: 31 December 2017



Sharon Hague  
Responsible Officer  
Pearson Education Ltd



PQS15 05198109 365

# Centre Approval Certificate

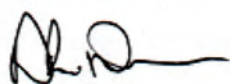
This is to certify that

**IMCS – Info Myanmar College**

is approved to offer BTEC Qualifications

**Centre Number: 95921**

Issued on: 1 May 2019

A handwritten signature in black ink, appearing to read "D.R.", with a long horizontal stroke extending to the right.

**Derek Richardson**  
Responsible Officer  
Pearson Education





### **Terms and conditions for Certificates for Approved or Recognised Centres.**

1. The issuance of this certificate attests that “you” (the centre named on the front of this certificate) have been approved as an approved or recognised centre by Pearson (“us” / “we”) as at the date on the face of this Certificate.
2. Your status as a recognised Pearson centre and your retention of this certificate is subject to your compliance with the terms and conditions contained in the form which you completed and signed on application for approved status, these terms and conditions, the identity guidelines and any other terms of guidance issued by us from time to time (collectively “**Pearson Terms and Conditions**”).
3. By retaining this certificate and/or displaying this certificate, you are deemed to accept the Pearson terms of approval. A copy of the Pearson terms are available from us on request or from our website under policies, Pearson UK Centre and Qualification Approval terms and Conditions.
4. You agree to us conducting any audit we deem necessary to ensure compliance with the Pearson Terms. We will give you reasonable notice of such an audit.
5. You are permitted to display this certificate at your premises (and nowhere else) to attest your status as a recognised Pearson centre. If your status is withdrawn or altered, we will send you a withdrawal notice and the provision of clause 10, below, will take effect.
6. This certificate is and will remain the property of Pearson Limited at all times.
7. This certificate is personal to you and is not transferable to any other company, centre or individual.
8. We reserve the right to withdraw this certificate and your status as a recognised centre if (a) at our discretion, you have failed to comply with Pearson terms (b) you become insolvent or cease to trade for any reason or (c) you are in arrears with any payments due to us.
9. You may notify us in writing if you wish your status as a recognised Pearson centre to be withdrawn. We are entitled at our discretion, to infer that this is your intention if you do not register or enter learners on Pearson Limited accredited courses for a period of 12 months. In all cases referred to in clauses 8 and 9, we will write to you giving you notice of withdrawal of this certificate (“**withdrawal notice**”).
10. Upon receipt of a withdrawal notice, you will immediately (a) return this certificate to us and (b) remove all references to Pearson Limited, any of our courses or any trade mark or trade name belonging to us from your premises and all and any of your promotional or advertising material.
11. You must not alter, deface or modify this certificate.
12. You may request that we make amendments or modifications to the certificate. We will act on these requests at our discretion.
13. You may not copy the certificate without written consent.
14. You must take reasonable security measures to prevent loss, theft of, or damage to, this certificate and you must notify us immediately if this certificate is lost, stolen or defaced. We may, at our discretion, issue you with a replacement.
15. The issuing of this certificate does not provide you with any licence to use any trademarks or intellectual property of Pearson Limited. We may separately licence you to use our intellectual property, including our trademarks and your use shall be subject to Pearson Terms.
16. The issuance of this Certificate does not create any joint venture, agency relationship or partnership between us.
17. We may vary or add to Pearson terms at our discretion and we will notify you of such variations in writing. If you do not wish to adhere to any variation, you may notify us in accordance with clause 9 above. Your retention of this certificate for a period of 30 days after receipt of the variation will be deemed acceptance of the varied terms.
18. Any disputes arising out of the issuance of this certificate shall be governed by, and construed by English Law and the Courts of England shall have non-exclusive jurisdiction.



**Info Myanmar University (IMU)**

ပေးအပ်မည့် သင်တန်းဆင်းလက်မှတ်၊  
အောင်လက်မှတ်နှင့်ဒီပလိုမာ၊ဘွဲ့လက်မှတ်၏  
နမူနာပုံစံများ





## *Under Teddy Third Graduate*

*has been awarded the degree of  
Bachelor of Science*

*having followed an approved programme in  
Computing*

*Monday 1 October 2018*

David Eustace  
Chancellor

Professor Andrea M Nolan OBE  
Principal & Vice-Chancellor

Ref Number  
98920



00048234



## *Under Teddy Third Graduate*

*has been awarded the degree of*

*Bachelor of Science*

*having followed an approved honours programme in*

*Computing*

*Monday 1 October 2018*

David Eustace  
Chancellor

Professor Andrea M Nolan OBE  
Principal & Vice-Chancellor

Ref Number  
98920



00048233



# UG RECORD OF ACADEMIC ACHIEVEMENT

Academic Session 2018/9

Programme Board Results

Edinburgh Napier  
UNIVERSITY

Course : Code 59411BD Course Name COMPUTING

Stage 3 Occ B Status AWARD Year Ave 0.00

Student : 40401634/1 Name HTET KYAW

HEIN

Date of Birth  
11-JUL-1997

Session	Taught Credit Summary by Session				Exemptions by Session			Overall Total
	CMP/C	CRE/O	OPT/E	Total	CMP/C	CRE/O	OPT/E	
2015/6					120.00			120.00
2016/7					120.00			120.00
2017/8	120.00			120.00				120.00
Total no. of Credits				120.00				360.00

	Taught Credit Summary by Level				Exemptions			Overall Total
	CMP/C	CRE/O	OPT/E	Total	CMP/C	CRE/O	OPT/E	
07					120.00			120.00
08	40.00			40.00	120.00			160.00
09	80.00			80.00				80.00
Total no. of Credits				120.00				360.00

Year	Sem	STATUS	Module	Name	Mod Credits	Agreed		Credits Gained	Att no.	Component 1			Component 2		
						Mark	Grade			AST	Weight	Mark	AST	Weight	Mark
2017/8	TR2	CMP	CSN08601	Computer Systems	20.00	58.0	P	20.00	1	C1	100%	58.0			
2017/8	TR2	CMP	CSN08614	Scripting for Cybersecurity and Networks	20.00	68.0	M	20.00	1	C1	100%	68.0			
2017/8	TR2	CMP	SET09603	Advanced Web Technologies	20.00	76.0	M	20.00	1	C1	100%	76.0			
2017/8	TR3	CMP	CSN09603	Networked Services	20.00	74.0	M	20.00	1	C1	100%	74.0			
2017/8	TR3	CMP	CSN09604	Wireless Local Area Networks	20.00	72.0	M	20.00	1	C1	100%	72.0			
2017/8	TR3	CMP	CSN09612	Network Security and Cryptography	20.00	61.8	P	20.00	1	C1	100%	61.8			

06-DEC-2018

# Pearson BTEC Level 5 HND Diploma

in COMPUTING AND SYSTEMS DEVELOPMENT (QCF)  
WITH DISTINCTION

is awarded to

U YINT MYAT KAUNG

who has completed an approved programme at  
IMCS - INFO MYANMAR COLLEGE

AWARDED : DECEMBER 2017

THIS DOCUMENT CONSISTS OF MORE THAN ONE PAGE

95921 : RFT47 : HE26172: 000032689:03:12:92:ISSUED 09-DEC-2017 : QN 500/8253/X

Regulated by  
**Ofqual**  
For more information see <http://register.ofqual.gov.uk>



*S Hague*

Sharon Hague  
Responsible Officer  
Pearson Education Ltd





# Notification of Performance

HE26172 MYINT MYAT KAUNG

LEVEL 5 PEARSON BTEC HND DIPLOMA 240+  
in COMPUTING AND SYSTEMS DEVELOPMENT (QCF)

The learner has been awarded the following credit for achieving the learning outcomes of the unit(s) listed

UNIT REF	TITLE	CREDIT VALUE AT LEVEL		GRADE
IMCS - INFO MYANMAR COLLEGE				
L/601/0446	COMPUTER SYSTEMS	15.0	4	DISTINCTION
R/601/0447	DATABASE DESIGN CONCEPTS	15.0	4	MERIT
K/601/1295	OBJECT ORIENTED PROGRAMMING	15.0	4	DISTINCTION
M/601/0472	NETWORKING TECHNOLOGIES	15.0	4	DISTINCTION
Y/601/1244	BUSINESS SKILLS FOR E-COMMERCE	15.0	4	DISTINCTION
M/601/1251	EMPLOYABILITY AND PROFESSIONAL DEVELOPMENT	15.0	4	MERIT
L/601/0995	PROJECT DESIGN, IMPLEMENTATION AND EVALUATION	20.0	5	MERIT
Y/601/1423	ROUTING CONCEPTS	15.0	4	DISTINCTION
Y/601/0448	DESIGN A SMALL OFFICE HOME OFFICE (SOHO) NETWORK	15.0	4	DISTINCTION
M/601/1444	INFORMATION SYSTEMS IN ORGANISATIONS	15.0	5	DISTINCTION
H/601/1456	DATA STRUCTURES AND ALGORITHMS	15.0	5	DISTINCTION
K/601/1510	WEB APPLICATIONS DEVELOPMENT	15.0	5	DISTINCTION
601/1513	INTERNET SERVER MANAGEMENT	15.0	5	DISTINCTION
301/1528	PROGRAMMING IN JAVA	15.0	5	DISTINCTION
D/601/1956	NETWORK SECURITY	15.0	5	PASS

( CONTINUED ON NEXT PAGE )

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S Hague

Sharon Hague  
Responsible Officer  
Pearson Education Ltd



# Notification of Performance

HE26172 MYINT MYAT KAUNG

LEVEL 5 PEARSON BTEC HND DIPLOMA 240+  
in COMPUTING AND SYSTEMS DEVELOPMENT (QCF)

The learner has been awarded the following credit for achieving the learning outcomes  
of the unit(s) listed

UNIT REF	TITLE	CREDIT VALUE AT LEVEL	GRADE
( CONTINUED FROM PREVIOUS PAGE )			
A/601/1933	IT VIRTUALISATION	15.0 5	PASS

THE LEARNER HAS QUALIFIED FOR THE ABOVE AWARD WITH  
GRADE DISTINCTION IN DECEMBER 2017

95921 : RFT47 : 03:12:92 : ISSUED 09-DEC-2017 : QN/500/8253/X

Regulated by  
**Ofqual**  
For more information see <http://register.ofqual.gov.uk>



*S Hague*

Sharon Hague  
Responsible Officer  
Pearson Education Ltd







Info Myanmar University (IMU)

ဝန်ဆောင်မှုပေးမည့် အစီအစဉ် နှင့်  
ဝန်ဆောင်ခ နှုန်းထားများ

ဝန်ဆောင်မှုပေးမည့် အစီအစဉ် နှင့် ဝန်ဆောင်ခ နှုန်းထားများ

Name of Institution Info Myanmar University(IMU)

စဉ်	သင်တန်း အမည်	ဘွဲ့၊ ဒီပလိုမာ လက်မှတ် အမည်	သင်တန်း ကာလ	သင်တန်း ကြေး	သင်တန်းသား အရေအတွက်	သင်တန်းသား အရေအတွက်	သင်တန်းသား အရေအတွက်	သင်တန်းသား အရေအတွက်	သင်တန်းသား အရေအတွက်
					၂၀၁၉	၂၀၂၀	၂၀၂၁	၂၀၂၂	၂၀၂၃
၁	PRE -HND	Foundation Certificate	4 Months	၁၅သိန်း	၁၇၀	၂၂၀	၂၄၀	၃၀၀	၃၃၀
၂	HNC	Higher National Certificate	1 Year	၃၈သိန်း	၁၂၀	၁၇၀	၂၀၀	၂၃၀	၂၈၀
၃	HND	Higher National Diploma	1 Year	၃၈သိန်း	၇၄	၁၂၀	၁၆၅	၁၉၀	၂၁၀
၄	B.Sc (Hons)	B.Sc (Hons) Computing	2 Years	USD 2500 နှင့်ညီမျှသော မြန်မာငွေ+ Partner University သို့ပေးသွင်းရသောကျောင်းလခ	၅၈	၇၀	၈၀	၉၅	၁၀၀
၅	M.Sc	M.Sc (Advanced Security & Digital Forensics)	2 Years	USD 3000 နှင့်ညီမျှသော မြန်မာငွေ+ Partner University သို့ပေးသွင်းရသောကျောင်းလခ	၂၀	၃၅	၄၈	၅၅	၇၅
				စုစုပေါင်း	၄၄၂	၆၁၅	၇၃၃	၈၇၀	၉၉၅

စဉ်	သင်တန်း အမည်	ဘွဲ့၊ ဒီပလိုမာ လက်မှတ် အမည်	သင်တန်း ကာလ	သင်တန်း ကြေး	သင်တန်းသား အရေအတွက်	သင်တန်းသား အရေအတွက်	သင်တန်းသား အရေအတွက်	သင်တန်းသား အရေအတွက်	သင်တန်းသား အရေအတွက်
					၂၀၂၄	၂၀၂၅	၂၀၂၆	၂၀၂၇	၂၀၂၈
၁	PRE -HND	Foundation Certificate	4 Months	၁၅သိန်း	၃၆၀	၄၀၀	၅၀၀	၅၅၀	၆၀၀
၂	HNC	Higher National Certificate	1 Year	၃၈သိန်း	၃၂၀	၃၅၀	၃၉၅	၄၉၀	၅၅၀
၃	HND	Higher National Diploma	1 Year	၃၈သိန်း	၂၆၀	၃၁၅	၃၄၅	၃၉၀	၄၈၀
၄	B.Sc (Hons)	B.Sc (Hons) Computing	2 Years	USD 2500 နှင့်ညီမျှသော မြန်မာငွေ+ Partner University သို့ပေးသွင်းရသောကျောင်းလခ	၁၀၅	၂၀၀	၂၅၀	၃၀၀	၃၅၀
၅	M.Sc	M.Sc (Advanced Security & Digital Forensics)	2 Years	USD 3000 နှင့်ညီမျှသော မြန်မာငွေ+ Partner University သို့ပေးသွင်းရသောကျောင်းလခ	၈၀	၉၅	၁၅၀	၂၁၀	၂၅၀
				စုစုပေါင်း	၁၁၂၅	၁၃၆၀	၁၆၄၀	၁၉၄၀	၂၂၃၀

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# **Edexcel BTEC Levels 4 and 5 Higher Nationals specification in Computing and Systems Development**

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## Unit 1: Business Skills for e-Commerce

**Unit code:** Y/601/1244

**QCF Level 4:** BTEC Higher National

**Credit value:** 15

### ● Aim

To enable learners to apply the business skills needed to design an e-Commerce solution for an organisation.

### ● Unit abstract

Organisations of all sizes, structures and aims can benefit from the opportunities made available by the intelligent application of communication based technologies and there will always be a need for practitioners who have a good understanding of those technologies. E-Commerce has become a vital part of an organisation's ability to reach out to the marketplace and position itself to maximise commercial returns on investment.

Poor choices of technology and processes will result in poorly managed opportunities which could lose business, market position and profitability. Learners will investigate the values of business skills by exploring current, topical examples of e-Commerce practices. Learners will consider how to design an e-Commerce solution to the best advantage of the organisation and its stakeholders (for example employees, suppliers and customers). Learners will explore current legislation concerning e-Commerce based trading, organisational responsibilities and finance/payment systems.

The first part of the unit considers the structure and aims of organisations to better understand how they could benefit from an e-Commerce structure. Then follows an opportunity to investigate and evaluate the impact of e-Commerce systems on organisations and their stakeholders. Once these areas have been studied the learner will be in a position to examine the process of the development of an e-Commerce presence followed by the opportunity to design an e-Commerce system.

### ● Learning outcomes

**On successful completion of this unit a learner will:**

- 1 Understand the structure and aims of business organisations
- 2 Understand the impact of e-Commerce
- 3 Be able to design e-Commerce solutions.

## Unit content

---

### 1 Understand the structure and aims of business organisations

*Organisations:* type eg private, public, voluntary, charitable business organisations; aims eg profit, market share, Return on Capital Employed (ROCE), sales; growth, customer service; Political, Economic, Social and Technological (PEST) analysis

*Stakeholders:* identification of stakeholders; satisfying stakeholder objectives; pluralist perspectives; the concept of corporate mission objectives and policies

*Business functions:* key internal business functions eg marketing, sales, accounting, administration; Management Information Systems (MIS), operations

### 2 Understand the impact of e-Commerce

*Consumer impact:* empowered customers eg online sales, direct communication with customers, greater choice, lower prices, availability of new products; global markets; new marketing models; on-line advertising

*Business impact:* global business and consumer markets; issues eg challenge of new technology, security issues, impact and implications of dealing with customers on-line, creating new distribution channels, greater competition, challenge to monopoly power, re-training of staff, lower overheads, new selling chains; legislation

### 3 Be able to design e-Commerce solutions

*Objectives:* business idea eg unique selling proposition, business-to-business opportunities, business to consumer markets; domain name

*Market research:* purpose of research eg identifying information sources, online and offline competition; types of research eg primary, secondary

*Target markets:* market analysis eg size, characteristics, dynamics, competitors, historical background, emerging trends, market share, market segmentation

*Key processes:* technology requirements eg hardware, software, security, maintenance, back end systems; supply sources; distribution channels

*e-Commerce:* payment systems eg electronic cheque, PayPal, NoChex, credit or debit cards; start-up capital; working capital; funding sources

*Security:* key areas eg prevention of hacking, viruses, identity theft, firewall, impact on site performance, Secure Sockets Layer (SSL), Secure HTTP (HTTPS), digital certificates, strong passwords, alternative authentication methods

*Legislation:* relevant legislation eg Data Protection Act 1998, Computer Misuse Act 1990, Consumer Credit Act 1974, Trading Standards, Freedom of Information Act 2000, copyright legislation

## Learning outcomes and assessment criteria

Learning outcomes  On successful completion of this unit a learner will:	Assessment criteria for pass  The learner can:
LO1 Understand the structure and aims of business organisations	1.1 assess an organisation's core business functions 1.2 evaluate an organisation's business aims and show how they relate to stakeholders
LO2 Understand the impact of e-Commerce	2.1 analyse the impact, including the risks, of introducing an e-Commerce system to an organisation 2.2 discuss the global impact of e-Commerce on society
LO3 Be able to design e-Commerce solutions	3.1 investigate market potential for an e-Commerce opportunity 3.2 evaluate current e-Commerce systems in use by organisations 3.3 discuss the financial implications of an e-Commerce solution 3.4 design an e-Commerce solution 3.5 evaluate the suitability of an e-Commerce solution.



## Guidance

### Links to National Occupational Standards, other BTEC units, other BTEC qualifications and other relevant units and qualifications

The learning outcomes associated with this unit are closely linked with:

Level 3	Level 4	Level 5
Unit 3: Information Systems	Unit 16: e-Commerce Technologies	Unit 29: e-Commerce Strategy
Unit 8: e-Commerce		Unit 30: Information Systems in Organisations
Unit 33: Exploring Business Activity		
Unit 34: Business Resources		

This unit has links to the Level 4 and Level 5 National Occupational Standards for IT and Telecoms Professionals, particularly the areas of competence of:

- Systems Analysis
- Systems Design
- Systems Development
- Change and Release Management
- Supplier Management.

### Essential requirements

Learners must have access to a wide range of material covering current and proposed e-Commerce implementations encompassing a number of organisations from small start-ups to large multi-nationals. The material can be sourced online, for example organisation websites, journals, newspapers, broadcast material and visiting speakers who are experts in their subject area.

## Resources

### Books

Chaffey D – *E-business and E-Commerce Management, Fourth Edition* (FT Prentice Hall, 2009) ISBN 0273719602

Courtland B, Thill J – *Business in Action* (Pearson, 2010) ISBN 0132546884

Hall D, Jones R, Raffo C, Anderton A, Chambers I and Gray D – *Business Studies* (Causeway Press, 2008) ISBN 1405892315

Laudon K, Guercio Traver C – *E-Commerce 2010: International Version: Business, Technology, Society* (Pearson, 2009) ISBN 0135090784

Malmsten E, Leander K, Portanger E and Drazin C – *Boo Hoo: A Dot.com Story from Concept to Catastrophe* (Arrow Books Ltd, 2002) ISBN 0099418371

Rich J – *Design and Launch an eCommerce Business in a Week* (Entrepreneur Magazine's Click Starts) (Entrepreneur Press, 2008) ISBN 1599181835

Ridderstrale J and Nordstrom K – *Funky Business Forever* (Prentice Hall, 2007) ISBN 0273714139

Stanwick P, Stanwick S – *Understanding Business Ethics* (Prentice Hall, 2008) ISBN 013173542X

Vise D – *The Google Story* (Pan, 2008) ISBN 0330508121

Wood G and Mellahi K – *The Ethical Business: Possibilities, Challenges and Controversies* (Palgrave Macmillan, 2002) ISBN 0333949935

### Journals

*Business Review Magazine* (Phillip Allan Publishers – see [www.phillipallan.co.uk](http://www.phillipallan.co.uk))

*The Economist* (The Economist Newspaper Group, Inc)

## Employer engagement and vocational contexts

Any opportunity to study an existing e-Commerce implementation, either developing or mature would be advantageous.



## Unit 2: Computer Systems

**Unit code:** L/601/0446

**QCF Level 4:** BTEC Higher National

**Credit value:** 15

### ● Aim

To enable learners to understand computer systems and apply theoretical knowledge to practical application when building, configuring and maintaining computer systems.

### ● Unit abstract

Most IT professionals will at some stage have to set up, use, customise and maintain computer systems. In order to do so effectively they will need to understand how computer systems work. Learners will understand the theoretical aspects of computer systems, and how information is processed. This unit explores the hardware, software and peripheral components that make up a computer system.

There are many different manufacturers of computer systems and each manufacturer will produce a wide range of models with different specifications. Deciding which particular model is appropriate for a given situation depends on a variety of factors. Custom-built computer systems are also an advantage when meeting specialised requirements, whilst maintaining performance and keeping costs low. These aspects are explored in this unit so that learners can make informed choices when designing a computer system for a given purpose.

Learners will be able to apply their theoretical knowledge to practical application by building, configuring and testing a functional computer system which will meet a given specification.

Computer users also need the skills required to set up and carry out routine maintenance of computer systems. Although this unit does not extensively cover fault finding and repair, it includes the basic maintenance skills that would normally be expected of most computer users.

### ● Learning outcomes

**On successful completion of this unit a learner will:**

- 1 Understand the function of computer systems
- 2 Be able to design computer systems
- 3 Be able to build and configure computer systems
- 4 Be able to undertake routine maintenance on computer systems.



## Unit content

---

### 1 Understand the function of computer systems

*Computer systems:* microcomputers eg personal computers; mobile computers; minicomputers eg mid-range servers, workstations; mainframes eg large scale network systems; supercomputers eg high performance systems; models; multiprocessing

*Environments:* home, business, computer gaming, networking, real-time, communication

*Function:* main components (Arithmetic Logic Unit (ALU), control unit, memory and input/output devices), connection eg busses; Central Processing Unit (CPU) (control unit, arithmetic logic unit, registers, input/output); memory (Random Access Memory (RAM), Read Only Memory (ROM), registers, programmable, cache), auxiliary storage; computer architecture

*Hardware:* central processing unit; motherboard, power supply unit, cooling units, backing storage eg hard disc drive; controllers, ports, main memory, memory types, battery, specialised cards eg Peripheral Component Interconnect (PCI), Accelerated Graphics Port (AGP), network, graphics, modem, sound, optical drives; performance factors

*Software:* systems software eg operating systems, utility programs, library programs, translator programs; applications software eg special purpose software, be-spoke software; performance factors

*Peripherals:* printers, plotters, cameras, scanners; keyboard and mouse; monitors, display adapters; multimedia devices; storage media; networking; portable drives; plug and play components; performance factors

### 2 Be able to design computer systems

*Needs analysis:* client and system requirements, problems/limitations with current/new system, functionality, costs, timescales, resources, investigation/analytical techniques eg interviews, questionnaires

*Selection:* costs, client requirements, maintenance contracts, outputs required, compatibility; system integration eg home entertainment; storage capacity; accessibility; performance eg speed, time, power, efficiency, effectiveness, usability, alternative solutions

*System specification:* client requirements, system requirements, system components, configuration, time, tools and resources, alternatives eg processor types, backup options; security measures; documentation

### 3 Be able to build and configure computer systems

*Health and safety:* health and safety practices; electrostatic precautions eg antistatic mats, antistatic wrist straps

*System installation:* hardware: assemble and disassemble a computer system; install motherboard, processor, heat-sink and fan, memory, power supply unit and connect to internal components; install hard disc drive, optical drive; install specialised cards eg graphics, network, modem, audio; install and configure software eg operating system, application software, utility software; install peripheral devices eg printer, scanner, camera; install communication devices eg modem, router

*System configuration:* configure Basic Input Output System (BIOS) eg date/time, power management, security; install latest antivirus/security updates; update user profiles; configure desktop, icon size, font size, colour, background, customise menu; file management, files and folders, setting file/folder sharing permissions; peripheral devices, printer, scanner, camera; communication devices

*System testing:* fault detection, Power On Self Test (POST), diagnostic faults, troubleshoot devices; technical support documentation eg reference manuals, online manufacturer support; test hardware eg input/output devices, peripheral devices; test software; documentation eg test plan

### 4 Be able to undertake routine maintenance on computer systems

*Software maintenance:* upgrade software eg virus definition files; patches/updates; scheduling maintenance tasks; utility software eg defragmentation, clean-up, back-up, system profilers; other third party utility software eg compression utilities, spyware/malware removal

*Hardware maintenance:* upgrade hardware; install and configure new peripherals eg printers, scanners; install and configure additional or replacement devices eg hard drive, memory, graphics, sound, optical media, network; cleaning equipment

*File management:* manage files/folders; back-up procedures

## Learning outcomes and assessment criteria

Learning outcomes On successful completion of this unit a learner will:	Assessment criteria for pass The learner can:
LO1 Understand the function of computer systems	1.1 explain the role of computer systems in different environments 1.2 explain the hardware, software and peripheral components of a computer system 1.3 compare different types of computer systems
LO2 Be able to design computer systems	2.1 produce a system design specification to meet a client's needs 2.2 evaluate the suitability of a system design specification
LO3 Be able to build and configure computer systems	3.1 build and configure a computer system to meet a design specification 3.2 test and document a computer system
LO4 Be able to undertake routine maintenance on computer systems	4.1 perform routine maintenance tasks on a computer system 4.2 upgrade the hardware and software on a computer system.

## Guidance

### Links to National Occupational Standards, other BTEC units, other BTEC qualifications and other relevant units and qualifications

The learning outcomes associated with this unit are closely linked with:

Level 3	Level 4	Level 5
Unit 2: Computer Systems	Unit 24: Networking Technologies	Unit 47: IT Virtualisation
Unit 5: Managing Networks	Unit 28: IT Support for End Users	Unit 48: IT Security Management
Unit 9: Computer Networks		
Unit 12: IT Technical Support		
Unit 13: IT Systems Troubleshooting and Repair		
Unit 25: Maintaining Computer Systems		
Unit 29: Installing and Upgrading Software		

This unit has links to the Level 4 and Level 5 National Occupational Standards for IT and Telecoms Professionals, particularly the areas of competence of:

- Systems Architecture
- Systems Design
- IT/Technology Infrastructure Design and Planning
- Systems Development
- IT/Technology Solution Testing
- IT/Technology Service Operations and Event Management
- IT Application Management/Support
- IT/Technology Management and Support
- Technical Evaluation.



## Essential requirements

Learners must have access to computer systems that they can disassemble, assemble and configure. They will also need a range of components and peripherals that they can install and configure.

Learners must understand the functions of computer systems before they can begin the practical aspects of this unit. It is important that the underpinning knowledge of computer systems supports the practical approach to building and configuring computer systems.

Centres must begin this unit by giving an overview of the topics that will be covered, and what benefits the unit will bring to those who aspire to get involved with IT support and networking. Centres must give a brief history of computer systems, and how they have evolved. The different generations of computer systems will be useful at this point. There are different types of computer systems, and this must be covered in detail in terms of their functionality, performance and where they are typically used (environments). The benefits and drawbacks of computer systems must also be discussed, particularly IT security. Centres must keep abreast of modern developments in computer systems, and must also present mobile computing technologies as well. The future of computer systems must also be covered in respect of emerging technologies.

Learners must explore the full range of hardware, software and peripheral components. Centres must demonstrate and explain the role of common components, including the central processing unit, memory, motherboard, power supply unit, optical drives, storage devices and specialised cards.

Centres must present a range of typical client and system requirements, and discuss the range of components needed to fulfil those requirements. The range of hardware, software and peripheral components covered in this unit is at the centre's discretion. However, these components must be available for practical activities to ensure that fully functional computer systems can be built.

Centres must cover health and safety guidelines before commencing any practical work, and ensure that the working environment is safe and hazard free. Learners must also practice using electrostatic equipment to prevent any damage to components. Centres must demonstrate (in stages) the processes involved with building, configuring and testing a functional computer system.

Computer systems at some stage will need to be monitored and maintained to ensure consistency, reliability and performance. Learners must be equipped with the skills to maintain computer systems and follow a recommended schedule of activities. Learners must also be able to upgrade a computer system.

## Resources

### Books

Anfinson, D – *IT Essentials: PC Hardware and Software Companion Guide* (Cisco Press, 2010)  
ISBN 158713263X

Dick, D – *The PC Support Handbook: The Configuration and Systems Guide* (Dumbreck Publishing, 2009) ISBN 9780954171131

MacRae K – *The Computer Manual: The Step-by-step Guide to Upgrading and Repairing a PC* (Haynes Group, 2002) ISBN 1859608884

MacRae K and Marshall G – *Computer Troubleshooting: The Complete Step-by-step Guide to Diagnosing and Fixing Common PC Problems, Second Edition* (Haynes Group, 2008)  
ISBN 1844255174

White R and Downs T – *How Computers Work* (Que, 2003) ISBN 0789730332

### Journals

*Computer Weekly*

*Which? Computer*

### Websites

[www.bized.co.uk](http://www.bized.co.uk)

[www.computerweekly.com](http://www.computerweekly.com)

## Employer engagement and vocational contexts

Working with a live system will present many risks, that the centre, employer and learner must be aware of using a current vocational context to deploy an additional or alternate solution will enhance the learners experience and enable understanding of wider technical application.



## **Unit 3: Employability and Professional Development**

**Unit code:** M/601/1251

**QCF Level 4:** BTEC Higher National

**Credit value:** 15

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- **Aim**

To provide learners with the opportunity to acquire employability skills required for effective employment and to manage their own personal and professional development.

- **Unit abstract**

All learners at all levels of education and experience require employability skills as a prerequisite to entering the job market. This unit gives learners an opportunity to assess and develop an understanding of their own responsibilities and performance in or when entering the workplace.

The unit considers the skills required for general employment such as interpersonal and transferable skills, and the dynamics of working with others in teams or groups including leadership and communication skills.

It also deals with the everyday working requirement of problem solving which includes the identification or specification of the 'problem', strategies for its solution and then evaluation of the results of the solution through reflective practices.

- **Learning outcomes**

**On successful completion of this unit a learner will:**

- 1 Be able to take responsibility for own personal and professional development
- 2 Be able to demonstrate acquired interpersonal and transferable skills
- 3 Understand the dynamics of working with others
- 4 Be able to develop strategies for problem solving.



## Unit content

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### 1 Be able to take responsibility for own personal and professional development

*Responsibilities:* own responsibilities eg personal responsibility, direct and indirect relationships and adaptability, decision-making processes and skills, ability to learn and develop within the work role; other eg employment legislation, ethics, employment rights and responsibilities

*Performance objectives:* setting and monitoring performance objectives

*Individual appraisal systems:* uses of performance appraisals eg salary levels and bonus payments, promotion, strengths and weaknesses, training needs; communication; appraisal criteria eg production data, personnel data, judgemental data; rating methods eg ranking, paired comparison, checklist, management by objectives; skills audit (personal profile using appropriate self-assessment tools); evaluating self-management; personal and interpersonal skills; leadership skills

*Motivation and performance:* application and appraisal of motivational theories and techniques, rewards and incentives; manager's role; self-motivational factors.

*Development plan:* current performance; future needs; opportunities and threats to career progression; aims and objectives; achievement dates; review dates; learning programme/activities; action plans; personal development plan

*Portfolio building:* developing and maintaining a personal portfolio

*Transcripts:* maintaining and presenting transcripts including curriculum vitae

### 2 Be able to demonstrate acquired interpersonal and transferable skills

*Effective communication:* verbal and non-verbal eg awareness and use of body language, openness and responsiveness, formal and informal feedback to and from colleagues; IT as an effective communication medium; team meetings

*Interpersonal skills:* soft skills eg personal effectiveness, working with others, use of initiative, negotiating skills, assertiveness skills, social skills

*Time management:* prioritising workloads; setting work objectives; using time effectively; making and keeping appointments; reliable estimates of task time

### 3 Understand the dynamics of working with others

*Working with others:* nature and dynamics of team and group work; informal and formal settings; purpose of teams and groups eg long-term corporate objectives/strategy; problem solving and short-term development projects; flexibility/adaptability; team player

*Teams and team building:* selecting team members eg specialist roles, skill and style/approach mixes; identification of team/work group roles; stages in team development eg team building, identity, loyalty, commitment to shared beliefs, team health evaluation; action planning; monitoring and feedback; coaching skills; ethics; effective leadership skills, eg, setting direction, setting standards, motivating, innovative, responsive, effective communicator, reliability, consistency

#### 4 **Be able to develop strategies for problem solving**

*Specification of the problem:* definition of the problem; analysis and clarification

*Identification of possible outcomes:* identification and assessment of various alternative outcomes

*Tools and methods:* problem-solving methods and tools

*Plan and implement:* sources of information; solution methodologies; selection and implementation of the best corrective action eg timescale, stages, resources, critical path analysis

*Evaluation:* evaluation of whether the problem was solved or not; measurement of solution against specification and desired outcomes; sustainability

## Learning outcomes and assessment criteria

Learning outcomes  On successful completion of this unit a learner will:	Assessment criteria for pass  The learner can:
LO1  Be able to take responsibility for own personal and professional development	1.1 reflect on own current skills and competencies against professional standards and organisational objectives 1.2 evaluate own development needs and the activities required to meet them 1.3 devise a personal and professional development plan based on identified needs 1.4 reflect on own development against original aims and objectives set in the personal and professional development plan
LO2  Be able to demonstrate acquired interpersonal and transferable skills	2.1 communicate in a variety of styles and appropriate manner at various levels 2.2 demonstrate effective time management strategies
LO3  Understand the dynamics of working with others	3.1 analyse team dynamics, discussing the roles people play in a team and how they can work together to achieve shared goals 3.2 discuss alternative ways to complete tasks and achieve team goals
LO4  Be able to develop strategies for problem solving	4.1 review tools and methods for developing solutions to problems 4.2 develop an appropriate strategy for resolving a particular problem 4.3 evaluate the potential impact on the business of implementing the strategy.

## Guidance

### Links to National Occupational Standards, other BTEC units, other BTEC qualifications and other relevant units and qualifications

The learning outcomes associated with this unit are closely linked with:

Level 3	Level 4	Level 5
Unit 1: Communication and Employability Skills for IT	Unit 3: Employability and Professional Development	Unit 4: Project Design, Implementation and Evaluation
		Unit 50: Work-based Experience

It also links with the following Asset Skills cross-sectoral Employability Matrix:

- Plan and manage time, money and other resources to achieve goals
- Find and suggest new ways to achieve goals and get the job done and achieve goals
- Plan for and achieve your learning goals
- Understand the roles people play in a group and how you can best work with them
- Lead or support and motivate a team to achieve high standards
- Find new and creative ways to solve a problem.

### Essential requirements

Access to a range of work-related exemplars (for example appraisal and development systems, team health checks, job descriptions, action plans, communication strategies, etc) would be of assistance in delivering this unit. Case studies based on relevant sectors, workshops, career talks and work-based mentors would also be useful in the teaching and learning aspect of the unit.

Learners can generate assessment evidence through a range of possible activities including individual work placements, project management, research reports, development of case studies, the process of working with others (eg employee – supervisor roles, teamwork, group work) and everyday communication within the workplace.



## Resources

### Books

NCCER – *Basic Employability Skills: Trainee Guide 00108-09* (Prentice Hall, 2009) ISBN 013609919X

Thompson Leigh, L – *Making the Team: A Guide for Managers* (Pearson Education, 2008)  
ISBN 9780136037767

### Websites

[www.prospects.ac.uk](http://www.prospects.ac.uk)

[www.stemnet.org.uk/resources/employability\\_skills\\_guide.cfm](http://www.stemnet.org.uk/resources/employability_skills_guide.cfm)

## **Unit 4: Project Design Implementation and Evaluation**

**Unit code:** L/601/0995

**QCF level 5:** BTEC Higher National

**Credit value:** 20

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- **Aim**

To develop learners' skills of independent enquiry by undertaking a sustained investigation of direct relevance to their vocational, academic and professional development.

- **Unit abstract**

This unit provides opportunities to develop skills in decision making, problem solving and communication integrated with the skills and knowledge developed in many of the other units within the programme to complete a realistic project.

It requires the learner to select, plan, implement and evaluate a project and finally present the outcomes, in terms of the process and the product of the project. It also allows learners to develop the ability to work individually and/or with others, within a defined timescale and given constraints, to produce an acceptable and viable solution to an agreed brief.

If this is a group project, each member of the team must be clear about their responsibilities at the start of the project and supervisors must ensure that everyone is accountable for each aspect of the work and makes a contribution to the end result.

Learners must work under the supervision of programme tutors or work-based managers.

- **Learning outcomes**

**On successful completion of this unit a learner will:**

- 1 Be able to formulate a project
- 2 Be able to implement the project within agreed procedures and to specification
- 3 Be able to evaluate the project outcomes
- 4 Be able to present the project outcomes.

## Unit content

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### 1 Be able to formulate a project

*Project selection:* researching and reviewing areas of interest; literature review; methods of evaluating feasibility of projects, initial critical analysis of the outline specification, selection of project option, initiating a project logbook/diary, estimating costs and resource implications, identifying goals and limitations; value of project, rationale for selection, agree roles and allocate responsibilities (individually with tutor/supervisor and within project group if appropriate)

*Project specifications:* developing and structuring a list of requirements relevant to project specifications eg costs, timescales, scale of operation, standards, legislation, ethics, sustainability, quality, fitness-for-purpose, business data, resource implications

*Procedures:* planning and monitoring methods; operating methods; lines of communication; risk analysis; structure of groups and collaborative working eg learner groups or roles and responsibilities within a work-based project; targets and aims

*Project plan:* production of a plan for the project including timescales, deliverables, milestones, quality assurance systems and quality plans; monitoring progress

### 2 Be able to implement the project within agreed procedures and to specification

*Implement:* proper use of resources, working within agreed time scale, use of appropriate techniques for generating solutions, monitoring development against the agreed project plan, maintaining and adapting project plan where appropriate

*Record:* systematic recording of relevant outcomes of all aspects and stages of the project to agreed standards

### 3 Be able to evaluate the project outcomes

*Evaluation techniques:* detailed analysis of results, conclusions and recommendations; critical analysis against the project specification and planned procedures; use of appropriate evaluation techniques; application of project evaluation and review techniques (PERT); opportunities for further studies and developments

*Interpretation:* use of appropriate techniques to justify project progress and outcomes in terms of the original agreed project specification

*Further consideration:* significance of project; application of project results; implications; limitations of the project; improvements; recommendations for further consideration

### 4 Be able to present the project outcomes

*Record of procedures and results:* relevant documentation of all aspects and stages of the project

*Format:* professional delivery format appropriate to the audience; appropriate media

## Learning outcomes and assessment criteria

Learning outcomes  On successful completion of this unit a learner will:	Assessment criteria for pass  The learner can:
LO1 Be able to formulate a project	1.1 formulate and record possible outline project specifications 1.2 identify the factors that contribute to the process of project selection 1.3 produce a specification for the agreed project 1.4 produce an appropriate project plan for the agreed project
LO2 Be able to implement the project within agreed procedures and to specification	2.1 match resources efficiently to the project 2.2 undertake the proposed project in accordance with the agreed specification 2.3 organise, analyse and interpret relevant outcomes
LO3 Be able to evaluate the project outcomes	3.1 use appropriate project evaluation techniques 3.2 interpret and analyse the results in terms of the original project specification 3.3 make recommendations and justify areas for further consideration
LO4 Be able to present the project outcomes	4.1 produce a record of all project procedures used 4.2 use an agreed format and appropriate media to present the outcomes of the project to an audience.



## Guidance

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### Links

This unit is suitable for use in all sectors and should utilise the full range of skills developed through study of other units in the programme. These include planning, practical work, data handling and processing, analysis and presentation skills. The knowledge applied may link to one particular unit or to a number of other units.

### Essential requirements

The required resources will vary significantly with the nature of the project. The identification of the equipment and materials required, and their availability, is a vital part of the planning phase. Learners should therefore have access to a wide variety of physical resources and data sources relevant to the project. Tutors should ensure that learners do not embark on work that cannot succeed because of lack of access to the required resources.

### Employer engagement and vocational contexts

Centres must establish relationships with appropriate organisations in order to bring realism and relevance to the project.

## Unit 5: Emerging Technologies

**Unit code:** Y/601/0451

**QCF Level 4:** BTEC Higher National

**Credit value:** 15

### ● Aim

To enable learners to explore current and cutting-edge technological developments, disciplines and advancements that have been, and are still being made, within the field of emerging technologies.

### ● Unit abstract

Emerging technologies can be explored in terms of significant research and development that is 'cutting-edge', innovative and dynamic. In other words, technologies that push the boundaries and exceed expectations.

This unit will provide learners with 'food for thought'. It will introduce a range of technologies that fall under this umbrella and explore the impact that such technologies could bring to society. The unit will provide learners with the opportunity to conduct research into this area and also enable them to draw their own conclusions about the benefits and also the concerns of having access to such technologies and their application in critical environments.

Learners will need to demonstrate a range of research and analytical skills. The information available to support certain technology developments might be limited, due to the stage of development. For example the technology might still be in a prototype stage with little to report on. Information available might also be confidential, due to the dynamics of the technology and findings of any experiments or tests.

On completion of this unit the learner will have an awareness and appreciation of emerging technologies, and how they can support the infrastructure of the environment and society in the future.

### ● Learning outcomes

**On successful completion of this unit a learner will:**

- 1 Understand emerging technologies
- 2 Understand the impact of emerging technologies on society
- 3 Be able to conduct research into emerging technologies
- 4 Understand the ethical implications of emerging technologies.

## Unit content

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### 1 Understand emerging technologies

*Definition:* cutting edge developments, contemporary advances in technology, converging technologies, technical innovations; gaining competitive advantage; disciplines and domains emerging technologies cover

*Environments:* prototype and fully-developed technologies eg low carbon technologies and fuels, nanotechnologies, biotechnology, information technology, cognitive science, robotics, genetic engineering, artificial intelligence, optical computing, 4G technologies, swarm technologies, medicine, transportation

### 2 Understand the impact of emerging technologies on society

*Current developments:* current research; development stages; future plans; costs; prototype models eg analysis of predicted/outcome results, implementation or roll-out of the technology, testing, costs

*Society:* implications eg electric car - impact upon manufacturers of cars, fuel companies, fuel distributors, consumers; government initiatives and legislation

### 3 Be able to conduct research into emerging technologies

*Emerging technology selection:* initial emerging technology case studies, research or investigation; environment to provide the basis of in-depth research into an emerging technology eg low-carbon fuels

*Research approaches:* using primary and or secondary sources of information to gather the research material and evidence; using qualitative and quantitative data sources; using paper-based and electronic information sources

*Research outcome:* presenting research findings and outcome; target audience for delivery and feedback; presentation delivery eg research paper, formal report, oral presentation, discussion forum, blog; tools eg statistical analysis tools, application software and professional packages to support delivery

### 4 Understand the ethical implications of emerging technologies

*Ethical implications:* ethical considerations and implications associated with emerging technologies; exploring ethics associated with testing emerging technologies and their environments eg laboratories

*Ethical committees:* ethical committees or bodies eg 3TU Centre for Ethics and Technology, United Nations Educational, Scientific and Cultural Organisation (UNESCO Ethics of Science and Technology Programme)

## Learning outcomes and assessment criteria

Learning outcomes  On successful completion of this unit a learner will:	Assessment criteria for pass  The learner can:
LO1 Understand emerging technologies	1.1 examine the environments that utilise emerging technologies by identifying the emerging technologies and current developments in the field  1.2 examine the environments that utilise emerging technologies by assessing the dependency of these environments on future enhancements
LO2 Understand the impact of emerging technologies on society	2.1 analyse emerging technologies and their impact on society
LO3 Be able to conduct research into emerging technologies	3.1 undertake research on an emerging technology 3.2 present findings from the research 3.3 evaluate the research process
LO4 Understand the ethical implications of emerging technologies	4.1 evaluate the ethical implications of emerging technologies discussing the role of ethical committees.



## Guidance

### Links to National Occupational Standards, other BTEC units, other BTEC qualifications and other relevant units and qualifications

The learning outcomes associated with this unit are closely linked with:

Level 3	Level 4	Level 5
	Unit 7: Research Skills	

This unit has links to the Level 4 and Level 5 National Occupational Standards for IT and Telecoms Professionals, particularly the areas of competence of:

- Human Needs Analysis
- Systems Design.

### Essential requirements

Learners must have access to a range of resources that can provide both qualitative and quantitative data to support their investigations and research. Learners must also keep up-to-date with current research developments in the field regarding emerging technologies.

Learners will be required to conduct research on emerging technologies. As this subject area is quite vast and covers a number of environments and disciplines, learners will require some direction in terms of where to find the most up-to-date developments or appropriate technologies. Any research that embraces IT or the use of IT would be appropriate, for example Artificial Intelligence (AI) technologies that could be used in medicine, or technologies used to monitor, predict or control certain designs or innovations.

### Resources

#### Websites

[http://en.wikipedia.org/wiki/Emerging\\_technologies](http://en.wikipedia.org/wiki/Emerging_technologies)

[www.cesweb.org/emergingTech/default.asp](http://www.cesweb.org/emergingTech/default.asp)

[www.technologyreview.com/special/emerging/](http://www.technologyreview.com/special/emerging/)

### Employer engagement and vocational contexts

To further enrich the content of this unit and to provide more of a vocational context, it would be beneficial to bring in guest speakers or use any conference footage that is available. The proceedings or coverage of any workshops may be quite engaging and informative.

## **Unit 6: Management in Information Technology**

**Unit code:** J/601/0462

**QCF Level 4:** BTEC Higher National

**Credit value:** 15

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- **Aim**

To enable learners to embrace the work-based activities expected of a technology manager, by providing the generic skills, knowledge and understanding required in the IT environment.

- **Unit abstract**

The unit will investigate and provide the generic skills, understanding, knowledge and work-based activities required by a manager in the information technology environment, thus enabling them to play an active role within an organisation.

Technology managers have to deal with change and participate effectively with management at all levels, including senior management, in the development and implementation of strategies. Learners will be introduced to the software tools available to support management and produce reports for financial planning and control.

In this unit learners will also use IT for strategic planning activities and evaluate the impact of IT on management as well as learn the importance of embracing new developments.

- **Learning outcomes**

**On successful completion of this unit a learner will:**

- 1 Understand principles of staff management
- 2 Be able to use software management tools
- 3 Be able to participate in strategic planning
- 4 Understand current developments in information technology.

## Unit content

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### 1 Understand principles of staff management

*Recruitment:* policies eg legal, job descriptions, selection criteria, preparation for interview, administrative and induction; line management structure

*Motivation:* current theories eg management of change, leadership, participation, team structure and management

*Administration:* tasks eg scheduling including links with project management, monitoring performance, appraisal, terms and conditions of employment; employer standards; systems and expectations; company policies and procedures

### 2 Be able to use software management tools

*Management planning* processes eg investigation of an organisation's budgetary procedures, bidding procedures, budgetary monitoring systems, production of financial reports, managing projects

*Software tools for management:* information system tools eg diary systems, spreadsheets, intranet, decision support systems; identification of tools with appropriate applications; project management software; management information systems

### 3 Be able to participate in strategic planning

*Strategic planning:* aim of strategic planning; use of IT in strategic planning; participating eg, contributing to disaster recovery plan, IT systems planning on strategic planning

*Maintaining currency:* research methods eg periodicals, internet, conference; human networking; accreditation; issues eg social, political, ethical, legal (UK, EU, global)

### 4 Understand current developments in information technology

*Developments in IT:* impact on management eg learning new skills, training; impact of the internet eg on senior and middle management

*Importance:* for management eg competitive advantage, efficiency, data analysis, deployment of staff (home working)

## Learning outcomes and assessment criteria

Learning outcomes  On successful completion of this unit a learner will:	Assessment criteria for pass  The learner can:
LO1 Understand principles of staff management	1.1 evaluate an organisation's staff recruitment policy 1.2 explain theories concerning staff motivation and the management of change 1.3 evaluate staff administration documentation
LO2 Be able to use software management tools	2.1 use system management tools to assist a company in their management planning process 2.2 effectively use software management tools
LO3 Be able to participate in strategic planning	3.1 critically evaluate the role of IT in strategic planning 3.2 use appropriate research methods to contribute to a company's strategic plan 3.3 discuss the issues associated with strategic planning
LO4 Understand current developments in information technology	4.1 evaluate the importance of embracing new developments in technology 4.2 analyse the impact of new technology on management.



## Guidance

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### Links to National Occupational Standards, other BTEC units, other BTEC qualifications and other relevant units and qualifications

The learning outcomes associated with this unit are closely linked with:

Level 3	Level 4	Level 5
Unit 3: Information Systems	Unit 5: Emerging Technologies	Unit 30: Information Systems in Organisations
Unit 4: Impact of the Use of IT on Business Systems		

This unit has links to the Level 4 and Level 5 National Occupational Standards for IT and Telecoms Professionals, particularly the areas of competence of:

- Information Management.

### Essential requirements

Centres are advised to build up a collection of appropriate scenarios and case studies to set the context for the topics covered. Centres must have appropriate tools for budgetary control, and presentation. There must also be materials to help learners keep abreast of current developments in information technology.

The unit has to be delivered within a realistic management context. Centres must provide the management tools, theories and systems to support the learner in satisfying the requirements of the unit.

## Resources

### Books

Aalders R, Hind P – *The IT Managers Survival Guide* (Wiley, 2002) ISBN 047084454X

Green M – *Change Management Masterclass: A Step-by-step Guide to Successful Change Management* (Kogan Page, 2007) ISBN 0749445076

Holtsnider B, Jaffe B – *IT Manager's Handbook Second Edition: Getting your new job done* (Morgan Kaufmann, 2006) ISBN 012370488X

MacDonald, Lynda – *How to Manage Problem Staff Successfully: Busy Manager's Guide to Managing Staff* (Emerald Guides, 2008) ISBN 1847160581

Robson W – *Strategic Management and Information Systems: An Integrated Approach* (Prentice Hall, 2007) ISBN 0273615912

### Websites

[www.itmanagement.com/](http://www.itmanagement.com/)

[www.computerweekly.com/it-management/](http://www.computerweekly.com/it-management/)

## Employer engagement and vocational contexts

Links with local organisations are paramount to the delivery of the unit. The setting of realistic scenarios supported by employer engagement and guest speakers will enhance learners' experience.



## Unit 7: Research Skills

**Unit code:** D/601/1276

**QCF Level 4:** BTEC Higher National

**Credit value:** 15

### ● Aim

To equip learners with the knowledge and research skills needed to select a research question, and design a research proposal for a chosen topic of interest.

### ● Unit abstract

Research skills equip learners with a higher level of knowledge and skills that will allow them to be self-directed and focused in a specific field of expertise. Research is undertaken in a range of disciplines and is quite prevalent in domains such as medicine, science and academia.

Research is paramount in terms of establishing what has been experienced and discovered in the past, relating this to current studies in the field, and providing some sort of hypothesis or prediction for the future.

Research involves the exploration of a range of primary and secondary sources of information. From these sources, conclusions can be drawn regarding a particular question or theory that may need to be investigated and tested. Submitting a research proposal, may be based upon these original findings, and through the adoption of a research methodology, new discoveries could be unearthed and recorded. There are a number of elements that contribute to research. These can include the application of a research methodology that will determine how the research is conducted and also whether it will be of a qualitative or quantitative nature. The research question should spearhead the studies and provide a focus on a specific area, idea, concept or development.

On completion of this unit learners should be able to conduct a literature review that will engage them in identifying a range of primary and secondary information sources. Learners will be able to critique sources and triangulate the information gathered to determine currency and validity in the area of study undertaken.

Learners will also engage in research seminars both as a participant and as a reviewer. The seminars will be used as a forum to disseminate good practice, and to create an awareness of topical issues within their chosen research field.

● **Learning outcomes**

**On successful completion of this unit a learner will:**

- 1 Understand different research methodologies
- 2 Know how to conduct a literature review
- 3 Be able to present a research proposal
- 4 Be able to contribute to a research seminar.



## Unit content

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### 1 Understand different research methodologies

*Research types and methodologies:* types eg experimental research, survey research, evaluative research, observational research, developmental research; applied versus fundamental research

*Data collection:* methods eg primary and secondary data collection, observatory, experimental

*Research pitfalls:* problems eg dependency and access to information sources, time, money, expertise, introduction of bias, the Hawthorne Effect, the Halo Effect

*Types of data:* qualitative eg 'information rich and data poor'; quantitative eg statistical analysis techniques, ratios

### 2 Know how to conduct a literature review

*Sources of information:* types eg visual, audio, paper-based, electronic; benefits and drawbacks of types; categories eg primary and secondary sources, restrictions and limitations

*Accuracy of information:* validity eg triangulation of resources to ensure validity; currency

*Literature review framework:* styles eg Harvard referencing; adopting a formal format

### 3 Be able to present a research proposal

*Research question:* defining the question eg selection and suitability; scope and boundaries; target audience

*Survey methods:* interview techniques eg unstructured, structured, semi-structured; administered questionnaire; attitude measurements eg Likert scaling, Thurstone scaling, Guttman scaling, semantic differential scaling; sampling eg random, quota, stratified

*Research ethics:* issues eg potential ethical issues arising during research, ways to address ethical issues in research; role of the Ethics Committee

### 4 Be able to contribute to a research seminar

*Research seminar:* functions eg disseminate ideas and good practice; discuss research proposals; gather feedback to inform proposals

*Delivery strategies:* structure eg clear framework; level of detail; use of IT

## Learning outcomes and assessment criteria

Learning outcomes  On successful completion of this unit a learner will:	Assessment criteria for pass  The learner can:
LO1 Understand different research methodologies	1.1 assess different research methodologies 1.2 justify the use of a research methodology to be used for the research proposal 1.3 discuss the importance of both qualitative and quantitative data in research 1.4 explain the problems that can arise when undertaking research
LO2 Know how to conduct a literature review	2.1 justify the use of research sources 2.2 evaluate the importance of using primary information sources 2.3 describe a recognised system for referencing
LO3 Be able to present a research proposal	3.1 present a research proposal to a defined audience utilising appropriate survey techniques 3.2 discuss the role of ethics in research
LO4 Be able to contribute to a research seminar	4.1 prepare an extract from the research proposal appropriate to a seminar environment 4.2 provide constructive feedback on proposals presented within the seminar environment.

## Guidance

### Links to National Occupational Standards, other BTEC units, other BTEC qualifications and other relevant units and qualifications

The learning outcomes associated with this unit are closely linked with:

Level 3	Level 4	Level 5
	Unit 5: Emerging Technologies	Unit 4: Project Design, Implementation and Evaluation
	Unit 8: Management of Projects	

### Essential requirements

Learners must have access to a range of texts, journals, papers, case studies, conference proceedings, and dissertation submissions. Learners must also keep up to date with current research developments in the field.

### Resources

#### Books

Burton N – *Doing Your Education Research Project* (Sage Ltd, 2008) ISBN 9781412947558

Fink A – *Conducting Research Literature Reviews: From the Internet to Paper, Third Edition* (Sage Inc, June 2009) ISBN 9781412971898

Kassem D, Mufti E and Robinson J – *Education Studies: Issues and Critical Perspectives* (Open University Press, 2006) ISBN 9780335219728

Sharp J – *Success with Your Education Research Project* (Learning Matters first edition, January 2009) ISBN 9781844451333

Wellington J – *Educational Research: Contemporary Issues and Practical Approaches* (Continuum International Publishing Group Ltd, 2000) ISBN 9780826449719

#### Journals

*Education Action Research*

*International Journal of Educational research*

*Journal of Dissertation*

*Research Ethics Review*

**Employer engagement and vocational contexts**

To further enrich the content of this unit and to provide more of a vocational context it would be beneficial to bring in researchers in different fields who can share their experiences of putting together a research proposal.

## Unit 8: Management of Projects

**Unit code:** J/601/0302

**QCF level:** 4

**Credit value:** 15

### ● Aim

This unit provides an understanding and experience of project management principles, methodologies, tools and techniques that may be used in industry and the public sector.

### ● Unit abstract

Management of projects is a key element to ensure successful scientific investigations related to academic research, company research and development or consultancy.

Through this unit learners will develop an understanding of what constitutes a project and the role of a project manager. They will examine the criteria for the success or failure of a project, evaluate project management systems and review the elements involved in project termination and appraisal.

Learners will also understand the need for structured organisation within the project team, effective control and coordination and good leadership qualities in the project manager. They will be able to analyse and plan the activities needed to carry out a project. This includes how to set up a project, how to control and execute a project, how to cost a project and how to carry out project reviews using a specialist project management software package. Together with factors associated with effecting project change, learners will also appreciate how the project fits into the strategy or business plan of an organisation.

### ● Learning outcomes

**On successful completion of this unit a learner will:**

- 1 Understand the principles of project management
- 2 Be able to plan a project in terms of organisation and people
- 3 Be able to manage project processes and procedures.



## Unit content

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### 1 Understand the principles of project management

*Project management:* project management and the role of the project manager eg management of change, understanding of project management system elements and their integration, management of multiple projects, project environment and the impact of external influences on projects; identification of the major project phases and why they are required; understanding of the work in each phase; the nature of work in the lifecycles of projects in various industries

*Success/failure criteria:* the need to meet operational, time and cost criteria; define and measure success eg develop the project scope, product breakdown structure (PBS), work breakdown structure (WBS), project execution strategy and the role of the project team; consideration of investment appraisal eg use of discount cash flow (DCF) and net present value (NPV); benefit analysis and viability of projects; determine success/failure criteria; preparation of project definition report; acceptance tests

*Project management systems:* procedures and processes; knowledge of project information support (IS) systems; how to integrate human and material resources to achieve successful projects

*Terminating the project:* audit trails; punch lists; close-out reports

*Post-project appraisals:* comparison of project outcome with business objectives

### 2 Be able to plan a project in terms of organisation and people

*Organisational structure:* functional, project and matrix organisational structures eg consideration of cultural and environmental influences, organisational evolution during the project lifecycle; job descriptions and key roles eg the project sponsor, champion, manager, integrators; other participants eg the project owner, user, supporters, stakeholders

*Roles and responsibilities:* the need for monitoring and control eg preparation of project plans, planning, scheduling and resourcing techniques

*Control and coordination:* use of work breakdown structures eg to develop monitoring and control systems, monitoring performance and progress measurement against established targets and plans; project reporting; change control procedures; the importance of cascading; communications briefing; instilling trust and confidence in others

*Leadership requirements:* stages of team development eg Belbin's team roles, motivation and the need for team building, project leadership styles and attributes; delegation of work and responsibility; techniques for dealing with conflict; negotiation skills; chair meetings

*Human resources and requirements:* calculation; specification; optimisation of human resource requirements; job descriptions

### 3 Be able to manage project processes and procedures

*Project organisation:* the product breakdown structure (PBS) and the work breakdown structure (WBS); project execution strategy and the organisation breakdown structure (OBS) eg preparation of organisational charts, task responsibility matrix, statement of work (SOW) for project tasks

*Project management plans:* the why, what, how, when, where and by whom of project management eg contract terms, document distribution schedules, procurement, establishing the baseline for the project

*Scheduling techniques:* relationship between schedules, OBS and WBS; bar charts; milestone schedules; network techniques; resourcing techniques; computer-based scheduling and resourcing packages; project progress measurement and reporting techniques; staff-hours, earned value and progress 'S' curves; critical path analysis and reporting; milestone trending

*Cost control techniques:* cost breakdown structure eg types of project estimate, resource needs, estimating techniques, estimating accuracy, contingency and estimation, bid estimates, whole-life cost estimates, sources of information, cost information sensitivity, computer-based estimating; allocation of budgets to packages of work; committed costs; actual costs; cash flow; contingency management

*Performance:* cost performance analysis eg budgeted cost for work scheduled (BCWS) budgeted cost for work performed (BCWP); concept of earned value; actual cost of work performed (ACWP); cost performance indicators

*Change control procedures:* the need for formal control of changes eg project impact of changes, principles of change control and configuration management; changes to scope, specification, cost or schedule; change reviews and authorisation; the formation of project teams; project initiation and start-up procedures

*Recommendations:* changes in relation to eg scope, specification, cost, improving reliability of outcomes

## Learning outcomes and assessment criteria

Learning outcomes  On successful completion of this unit a learner will:	Assessment criteria for pass  The learner can:
LO1  Understand the principles of project management	1.1 explain the principles of project management 1.2 discuss viability of projects with particular emphasis on the criteria for success/failure 1.3 explore principles behind project management systems and procedures 1.4 explain key elements involved in terminating projects and conducting post-project appraisals
LO2  Be able to plan a project in terms of organisation and people	2.1 plan the most appropriate organisational structure 2.2 discuss roles and responsibilities of participants within a project 2.3 carry out the control and co-ordination of a project 2.4 document project leadership requirements and qualities 2.5 plan specific human resources and requirements for a project
LO3  Be able to manage project processes and procedures	3.1 design the project organisation with reference to prepared project management plans 3.2 use project scheduling and cost control techniques 3.3 report the methods used to measure project performance 3.4 report project change control procedures 3.5 discuss the outcomes of the project and make recommendations.

## Guidance

### Links to National Occupational Standards, other BTEC units, other BTEC qualifications and other relevant units and qualifications

The learning outcomes associated with this unit are closely linked with:

Level 3	Level 4	Level 5
Unit 17: Project Planning With IT	Unit 7: Research Skills	Unit 4: Project Design, Implementation and Evaluation

### Essential requirements

Software packages must be used to demonstrate project control and reporting techniques. Packages might include time and cost scheduling packages, documentation and procurement control packages, spreadsheet packages, graphic presentation packages.

Other packages for items such as risk analysis, project accounting and procurement control could be used to illustrate particular techniques in specific industries.

Access to real project data in electronic spreadsheet form would be an advantage.

### Employer engagement and vocational contexts

Learners will benefit from visits to organisations that are engaged in project work as a part of academic research, investigations and research for public bodies, company research and development, or consultancy activities. An ideal context would be for learners to manage a project that is of interest to a particular organisation.





## Unit 9: Systems Analysis and Design

**Unit code:** K/601/1281

**QCF Level 4:** BTEC Higher National

**Credit value:** 15

### ● Aim

To provide learners with the knowledge and skills needed to undertake a systems analysis investigation by following a recognised methodology.

### ● Unit abstract

The systems life cycle provides a comprehensive framework for initially capturing data and information through a feasibility study and the use of recognised fact-finding techniques. Learners will be encouraged to identify and consider a full set of stakeholder interests to be sure that the wider implications of any development are considered.

To provide perspective, learners will examine different life cycle models and appreciate their particular strengths and weaknesses and to which situations they are most appropriate. Theoretical understanding will be translated into practical skills through actual systems investigations and learners will become confident in the use of particular tools and techniques relevant to the methodology chosen. Although for practical purposes, it is likely that one particular methodology and related tools and techniques will be chosen for practical work, it is important that learners understand that others are available.

### ● Learning outcomes

**On successful completion of this unit a learner will:**

- 1 Understand different systems life cycles
- 2 Understand the importance of a feasibility study
- 3 Be able to perform a systems investigation.

## Unit content

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### 1 Understand different systems life cycles

*Lifecycle models:* examples eg Systems Development Life Cycle (SDLC), Rapid Applications Design (RAD), Spiral, Agile, Dynamic Systems Design Methodology (DSDM), Waterfall and Prototyping

*Lifecycle procedure/stage:* lifecycle stages within different models; lifecycle stages examples eg (feasibility study, analysis, design, implementation, testing, review) or (analysis, design, implementation, maintenance, planning)

### 2 Understand the importance of a feasibility study

*Fact-finding techniques:* eg, interviews, observation, investigation of documentation, questionnaires, focus groups

*Feasibility criteria:* issues eg legal, social, economic, technical, timescales; organisational constraints

*Components:* purpose; structure; intended audience; outcomes

### 3 Be able to perform a systems investigation

*Identify requirements:* stakeholders; requirements identification; requirements specification eg scope, inputs, outputs, processes and process descriptors; consideration of alternate solutions; quality assurance required

*Constraints:* specific to activity eg costs, organisational policies, legacy systems, hardware platforms

*Report documentation:* structure eg background information, problem statements, data collection process and summary, recommendations, appendices

*Systems analysis terminology and tools:* data stores and entities; data flows; process representation techniques relationships – 1:1, 1:Many (1:M) and Many: Many (M:M)

*Investigation:* eg upgrading computer systems, designing new systems

*Techniques:* examples relevant to methodology chosen eg Context Diagrams, Data Flow Diagrams (DFDs), Entity Relationship Diagrams (ERDs); Business Systems Options (BSOs); Technical Systems Options (TSOs); quality considerations eg Total Quality Management (TQM)

## Learning outcomes and assessment criteria

Learning outcomes On successful completion of this unit a learner will:	Assessment criteria for pass The learner can:
LO1 Understand different systems life cycles	1.1 evaluate different systems lifecycle models 1.2 discuss the importance of following a procedural/staged lifecycle in a systems investigation
LO2 Understand the importance of a feasibility study	2.1 discuss the components of a feasibility report 2.2 assess the impact of different feasibility criteria on a systems investigation
LO3 Be able to perform a systems investigation	3.1 undertake a systems investigation to meet a business need 3.2 use appropriate systems analysis tools and techniques to carry out a systems investigation 3.3 create documentation to support a systems investigation 3.4 evaluate how user and systems requirements have been addressed.

## Guidance

### Links to National Occupational Standards, other BTEC units, other BTEC qualifications and other relevant units and qualifications

The learning outcomes associated with this unit are closely linked with:

Level 3	Level 4	Level 5
Unit 11: Systems Analysis and Design	Unit 1: Business Skills for e-Commerce	

This unit has links to the Level 4 and Level 5 National Occupational Standards for IT and Telecoms Professionals, particularly the areas of competence of:

- Systems Analysis.

### Essential requirements

Learners must have access to a range of systems environments, in addition to more traditional texts, journals and case studies. Learners must also keep up to date with current systems developments in the field.

Learners must be encouraged to investigate a range of systems analysis methodologies and practices. Realistic business scenarios must be chosen wherever possible to provide as wide a perspective as possible. It is important for learners to consider all stakeholders in any activity because failure to do so is often one of the reasons why new systems do not fulfil the stated requirements.

The feasibility study is one of the most important stages in the lifecycle. If data and information is not obtained from users about the existing environment, problems, or requirements for a new or revised system then the investigation will be flawed. Delivery must therefore reflect this and expose learners to a range of information collecting techniques and their appropriateness in certain environments. Learners must also be encouraged to use a good variety of information collecting devices.

### Resources

#### Books

Dennis A and Haley Wixom B – *Systems Analysis and Design* (John Wiley & Sons Ltd, 2009) ISBN-10: 0470400315

Lejk M and Deeks D – *An Introduction to System Analysis Techniques, 2nd Edition* (Addison Wesley, 2002) ISBN-10: 0201797135

#### Websites

[www.freetutes.com/systemanalysis/](http://www.freetutes.com/systemanalysis/)

**Employer engagement and vocational contexts**

To further enrich the content of this unit and to provide more of a vocational context it would be beneficial to bring in analysts or employers from organisations that have had exposure to systems analysis.





## Unit 10: Human Computer Interaction

**Unit code:** A/601/0457

**QCF Level 4:** BTEC Higher National

**Credit value:** 15

### ● Aim

This unit aims to give learners an understanding of recent Human Computer Interaction (HCI) developments and will enable them to develop a human computer interface.

### ● Unit abstract

As technology moves forward, new methods of communicating with computer systems are becoming possible. Developers need to make reasoned choices as to the nature and appropriateness of the interface they are developing or using, in order to ensure that the user interaction is as natural, efficient and effective as possible. This requires a good understanding of the essentials of HCI and of the latest developments. A long-term goal of HCI is to design systems that minimise barriers between the human's cognitive model of what they want to do and the computer's understanding of the user's intent.

Learners will be encouraged to explore the detail of how users interact with software, how the interface works to help fulfil the user needs and how it makes allowances for different users. Learners will develop a critical appreciation of the advantages and disadvantages of various interfaces currently available and develop an HCI using an appropriate programming language or software tool.

### ● Learning outcomes

**On successful completion of this unit a learner will:**

- 1 Understand recent human computer interaction related developments and their application
- 2 Understand the issues related to a chosen human computer interface
- 3 Be able to develop a human computer interface.

## Unit content

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### 1 Understand recent human computer interaction related developments and their application

*HCI:* historical development; motivation; techniques; guidelines; principles; standards.

*Developments in technology:* changing workstation environments eg screens, keyboards, pointing devices; other non standard input/output devices eg speech recognition; related processing developments and information storage possibilities

*Developments in HCI:* examples eg virtual machines with command line input, graphical interfaces, screen design for intensive data entry; intelligent HCIs; virtual personas; changing concepts of 'look and feel'

*User issues:* range of users eg expert, regular, occasional, novice, special needs; ergonomics; human information processing; impact on the workplace

*Development of systems:* new developments eg event-driven systems, use of multimedia; modelling techniques; implication of new developments on user interfaces; implication of developments on hardware eg storage, processing requirements; convergence of systems

*Applications:* selection of HCIs eg touchscreen, voice activated

### 2 Understand the issues related to a chosen human computer interface

*User characteristics:* human memory: knowledge representation; perception; attention; reasoning; communication; skills and skills acquisition; user's cognitive model; use of metaphors and the consequences on the design of HCI

*Health and safety considerations:* ergonomics and the surrounding environment eg lighting, seating; specific concerns eg Repetitive Strain Injury (RSI); legal implications

*Wider considerations:* costs; training; system requirements eg hardware, software, communications; information storage; health and safety

### 3 Be able to develop a human computer interface

*Modelling the interface:* mapping the system functionality to the conceptual model; grouping of the tasks into logical sets

*Analysis:* task analysis; user-centred methodologies eg storyboarding, user needs analysis; HCI options; usability objectives eg performance or response requirements

*Design:* rules and heuristics for HCI design; review of proprietary examples; supporting information eg context sensitive help, online help/documentation; design tools; design principles eg tolerance, simplicity, consistency, provision of feedback.

*Production:* selection of tools; production of interface; testing

*Evaluating an HCI:* functionality characteristics eg keystroke effort per task; ability to navigate within the system; ability to configure the HCI; user satisfaction against requirements; use of quality metrics eg Fitt's Law, Keystroke Level Method; test documentation

## Learning outcomes and assessment criteria

Learning outcomes  On successful completion of this unit a learner will:	Assessment criteria for pass  The learner can:
LO1 Understand recent human computer interaction related developments and their application	1.1 evaluate recent HCI related developments and their applications 1.2 discuss the impact of HCI in the workplace
LO2 Understand the issues related to a chosen human computer interface	2.1 discuss the issues related to user characteristics for a chosen HCI
LO3 Be able to develop a human computer interface	3.1 design and create a human computer interface for a specified application 3.2 explain the principles that have been applied to the design 3.3 critically review and test an interface 3.4 analyse actual test results against expected results to identify discrepancies 3.5 evaluate independent feedback and make recommendations for improvements 3.6 create onscreen help to assist the users of an interface 3.7 create documentation for the support and maintenance of an interface.

## Guidance

### Links to National Occupational Standards, other BTEC units, other BTEC qualifications and other relevant units and qualifications

The learning outcomes associated with this unit are closely linked with:

Level 3	Level 4	Level 5
Unit 23: Human Computer Interaction	Unit 11: Digital Media in Art and Design	Unit 37: Digital Image Creation and Development
	Unit 12: 2D, 3D, and Time-based Digital Applications	Unit 38: 3D Computer Modelling and Animation
	Unit 13: Multimedia Design and Authoring	
	Unit 14: Website Design	

This unit has links to the Level 4 and Level 5 National Occupational Standards for IT and Telecoms Professionals, particularly the areas of competence of:

- Human Computer Interaction/Interface (HCI) Design.

### Essential requirements

Learners must have access to a cross-section of applications on differing platforms presenting a range of HCI. Learners should also have access to a development environment that allows rapid prototyping.

This unit must be a balance between theory and practical experience. Learners must be exposed to a range of HCIs as possible, and be encouraged to criticise them. Where possible, tools for developing software prototypes must be used to allow the rapid production of HCIs. The design of the HCI must be seen as an integral part of the software development process.

Evidence can be obtained from investigating a wide range of HCI applications. Learners must show that they are capable of identifying the main features of a given HCI, that they can diagnose the failings of the interface and propose improvements in the light of user needs.



**Resources****Books**

Benyon D – *Designing Interactive Systems: A Comprehensive Guide to HCI and Interaction Design* (Addison Welsley, 2010) ISBN 0321435338

Sharp H, Rogers Y and Preece J – *Interaction Design: Beyond Human-computer Interaction* (Wiley, 2007) ISBN 0470018666

**Website**

<http://hcibib.org/>

**Employer engagement and vocational contexts**

Where learners are employed, a project-based assessment would enhance the delivery of this unit. Also, practical demonstrations of HCI, illustrated by speakers from commerce and industry, and of group visits to relevant organisations would contextualize the unit and be of value.



## Unit 11: Digital Media in Art and Design

**Unit code:** H/601/6608

**QCF Level 4:** BTEC Higher National

**Credit value:** 15

### ● Aim

The aim of this unit is to develop learners' understanding of the scope and potential of digital media in art and design, coupled with the application of skills in and detailed knowledge of, software applications in a specialist pathway.

### ● Unit abstract

The aim of this unit is to develop learners skills with digital media, combined with the ability to translate ideas from research and drawings into computer-aided design work and visuals. Learners should be given the opportunity to develop their in-depth knowledge of software and be able to communicate ideas using a variety of specialist CAD packages.

Learners should broaden their awareness of the benefits of using digital media inside and beyond the remit of art and design. The range of devices and software mentioned is not exhaustive and learners are encouraged to research beyond design applications to gain a broader view.

The aim is to ensure that learners are familiar with a wide range of essential technology and are able to translate these skills into their own work. As technology develops and moves on, learners must be familiar with current software and emerging trends in digital technology.

A creative experimental approach is required to encourage learners to broaden their design work and to understand how digital media can be used in art and design in a variety of situations, eg creating and developing images, using text and images, creating documents, and creating design work, producing professional standard visuals, concept sheets, design work, environments, renders, fly-throughs, storyboards. Learners should be able to use digital media as a tool to produce supporting documents, eg publicity and promotional materials, presentations, professional materials.

### ● Learning outcomes

**On successful completion of this unit a learner will:**

- 1 Understand the scope and potential of digital media in art and design
- 2 Know how to apply and utilise software in specialist pathway
- 3 Be able to exploit the potential of software applications creatively and effectively
- 4 Be able to present design work using digital applications.

## Unit content

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### 1 Understand the scope and potential of digital media in art and design

*Scope:* application eg illustration applications, interior design, background, render, CSS, moving image, environments, games levels, database driven, collaborative, reactive, 3D, graphic products, product design, web based design, interactive media, marketing, business administration

*Resources:* hardware eg, digitising tablet, pressure sensitive stylus, mouse, touch-screen, motion sensor, camera, projector, printer, scanner, hard drive, laser cutter

### 2 Know how to apply and utilise software in specialist pathway

*Software applications:* manipulate eg capture, distort, scale, warp, contrast, invert, palette, create swatches, repeat tiles, mask, vector, layer, filter

*Digitise:* capture eg digital photography, scan

*Objects:* primary sources eg found objects, natural objects, domestic tools, own work

*Image:* visuals eg photographs, found images, own visual work, hand-written text, word-processed text

*File format:* industry standards eg tiff, png, jpeg, gif, pdf, high resolution, low resolution, dpi, pixel size, international paper size, web page, web format, print format

*Pathway:* specialism eg fine art, fashion, textiles, design, graphics, photography, 3D, craft, art and design management, interior design, product design, manufacturing, printmaking, sculpture, interactive media

### 3 Be able to exploit the potential of software applications creatively and effectively

*Text editing:* word processing eg word count, spell checker, grammar checker, formatting styles, font styles, headers and footers, page layout, columns, table, track changes

*Image creation:* specialist output eg CSS, moving image, environments, games levels, design led, 3D rendering, repeat patterns, freehand files; traditional eg, drawn images, sketches, 3D, photographs

*Creative use of software:* personal approach eg layering, masking, visual language, personal style, innovation, originality, observation, fluency, confidence

### 4 Be able to present design work using digital applications

*Present visuals:* presentation materials eg slide-show, projection, folio, illustration, concept boards, design sheets, orthographic drawings, scale plans, layout, floor-plan, storyboard, render, mock-up; evaluation eg justification, development of ideas, application of software, skills development, communication of intended message, audience feedback, annotation, self-evaluation

## Learning outcomes and assessment criteria

Learning outcomes On successful completion of this unit a learner will:	Assessment criteria for pass The learner can:
LO1 Understand the scope and potential of digital media in art and design	1.1 Research and evaluate the use of digital media in art and design
LO2 Know how to apply and utilise software in specialist pathway	2.1 Create complex and original imagery using specialist software 2.2 Exploit potential of specialist software
LO3 Be able to exploit the potential of software applications creatively and effectively	3.1 Produce creative and effective design work using software application 3.2 Prepare image, graphic and text files for output 3.3 Produce a comprehensive portfolio that shows the creative application of specialist software
LO4 Be able to present design work using digital applications	4.1 Present visual design work 4.2 Evaluate the use of digital media in creating successful art and design outputs.



## Guidance

### Links to National Occupational Standards, other BTEC units, other BTEC qualifications and other relevant units and qualifications

The learning outcomes associated with this unit are closely linked with:

Level 3	Level 4	Level 5
Unit 30: Digital Graphics	Unit 12: 2D, 3D, and Time-based Digital Applications	Unit 37: Digital Image Creation and Development
Unit 35: Digital Graphics for Interactive Media	Unit 13: Multimedia Design and Authoring	Unit 38: 3D Computer Modelling and Animation
Unit 37: 2D Animation Production	Unit 14: Website Design	

This unit has links to the Level 4 and Level 5 National Occupational Standards for IT and Telecoms Professionals, particularly the areas of competence of:

- Human Computer Interaction/Interface (HCI) Design.

### Essential requirements

This unit requires access to computer suites with current software and a range of hardware including scanners, cameras, A3 colour printers and graphic tablets. Access to drawing studios is also necessary to enable learners to translate ideas from drawing to designs. Research tools include the internet, CD ROMs, databases, specialist publications, galleries, exhibitions, questionnaires and interviews with practitioners, software manuals, trend forecasting, graphic design magazines.

### Employer engagement and vocational contexts

Off site visits, work experience or visiting speakers related to the concept of digital media in art and design will help to contextualise this unit for learners and see the benefits on their future career aspirations. Competence and fluency with software is a skill that employers will be looking for and which will be useful to learners wishing to work for themselves in the future.

- Marketing – producing publicity materials, keeping databases, producing blogs, advertising
- Business – day to day business administration, finance and budget management
- Design – surface pattern design, fabric design, fine art, 3D design, graphic products, interior design,
- Presentation – creating mood boards, concept boards and presentation images.

**Vocational learning support resources:**

- Learning and Skills Network.– [www.vocationallearning.org.uk](http://www.vocationallearning.org.uk)

Business and finance advice:

- Local, regional business links – [www.businesslink.gov.uk](http://www.businesslink.gov.uk).

Assignments should be vocationally relevant; centres should consider the delivery of 'live projects' for example to support the vocational content of the unit and programme.



## Unit 12: 2D, 3D and Time-based Digital Applications

**Unit code:** F/601/6793

**QCF Level 4:** BTEC Higher National

**Credit value:** 15

### ● Aim

This unit aims to develop learners' skills in using a broad set of software applications through the use of 2D, 3D and time-based digital techniques.

### ● Unit abstract

This unit introduces learners to 2D, 3D and time-based digital applications. The scope offered to the designer working with these interactive tools is wide ranging. Creative approaches can be applied to exploring the potential of software applications in extending drawing and painting techniques. There are possibilities for both artists and designers to develop new strategies in working practices through reflection and reaction to the results of digital experimentation. In this unit learners should explore bitmap and vector graphic applications, and address the constraints associated with modelling 3D. They should also reflect on the potential of time-based software to be applied to creative and effective presentations of these elements.

An active experimental approach should encourage learners to broaden their visual thinking and creativity. The potential of combining drawing techniques and digital technology should be promoted widely to cross-fertilise creativity and to explore ways to integrate computer applications with art and design practice involving hand made imagery. Learners should explore 3D computer modelling techniques to create a basic 3D model or environment. This work should be combined with 2D digital artwork and incorporated in a presentation that uses time-based software.

### ● Learning outcomes

**On successful completion of this unit a learner will:**

- 1 Be able to carry out a sustained exploration of 2D mark making techniques using software tools
- 2 Be able to develop the potential of images using digital techniques
- 3 Be able to carry out a sustained exploration of 3D modelling software
- 4 Be able to present outcomes creatively and effectively, using time-based Presentation software.

## Unit content

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### 1 Be able to carry out a sustained exploration of 2D mark making techniques using software tools

*2D software:* industry standard; vector; compositional; image manipulation

*Bitmap and vector graphics:* pixels; picture elements; painting; objects; bounding boxes; stretch; distort; paths; pen tool; file formats; digital mark-making techniques

*Drawing devices:* graphics tablet; light pen; mouse; touch-screen; touch pad; stylus; puck; interactive whiteboard

### 2 Be able to develop the potential of images using digital techniques

*Manipulation:* adjust colour; contrast; brightness; size; resolution; texture; form; cut; copy; paste; repeat; collage; layer; add text; cyclical process eg print out, rework printed copy, re-scan

*Use techniques:* distortion; filters; curves; crop; adjust; enhance; styles; palettes; channels; transparency; opacity; invert; posterise; additive; reductive

*Document:* record; stages; saving protocols; versions; sequential eg development, layering; additive; reductive

### 3 Be able to carry out a sustained exploration of 3D modelling software

*Simple objects:* articulation; pivotal motion; axis; rotation; objects eg toy, sunglasses, tool, hinge, wheel, door, can opener

*Animation:* movement; tween; morph; keyframe; timeline

*Render:* modeling; surfaces eg textures, colour; light sources; reflective light; colour theory

### 4 Be able to present outcomes creatively and effectively, using time-based presentation software

*Presentation:* preparation; files; consideration eg final output, physical size, resolution; printing requirements; files eg combining, compatibility, economy, physical size, palette, screen resolution

*Combine:* elements eg drawn vector based imagery, graphics, text

*Software:* eg presentation, movie, video log, sound; format eg projection, installation

*Evaluate:* planning; intuition; response; technology; communication; content; format; intentions; reactions



## Learning outcomes and assessment criteria

Learning outcomes  On successful completion of this unit a learner will:	Assessment criteria for pass  The learner can:
LO1  Be able to carry out a sustained exploration of 2D mark making techniques using software tools	1.1 research examples of 2D digital based markmaking 1.2 use 2D software tools to produce digital artwork
LO2  Be able to effectively exploit the potential of images using digital techniques	2.1 use digital image manipulation techniques to create effective images 2.2 document the image manipulation process
LO3  Be able to carry out a sustained exploration of 3D modelling software	3.1 model simple objects using 3D modelling software 3.2 render models with surface texture and lighting 3.3 animate models using accurate parameters of movement
LO4  Be able to present outcomes creatively and effectively, using time-based presentation software	4.1 research approaches to using time-based presentation software 4.2 combine 2D and 3D elements into time-based presentation software 4.3 present final outcome 4.4 evaluate final outcome.

## Guidance

### Links to National Occupational Standards, other BTEC units, other BTEC qualifications and other relevant units and qualifications

The learning outcomes associated with this unit are closely linked with:

Level 3	Level 4	Level 5
Unit 30: Digital Graphics	Unit 11: Digital Media in Art and Design	Unit 37: Digital Image Creation and Development
Unit 35: Digital Graphics for Interactive Media	Unit 13: Multimedia Design and Authoring	Unit 38: 3D Computer Modelling and Animation
Unit 37: 2D Animation Production		

This unit has links to the Level 4 and Level 5 National Occupational Standards for IT and Telecoms Professionals, particularly the areas of competence of:

- Human Computer Interaction/Interface (HCI) Design.

### Essential requirements

Learners must have access to specialist facilities relevant to this unit.

### Employer engagement and vocational contexts

Centres should develop links with practising artists, craftspeople and designers, to deliver assignments to learners or to provide work experience. A lecture or visit by a designer, programmer or practitioner local to the centre may provide useful and pertinent information on working practice.

Links with employers are essential to the delivery of the programme for work experience and future employment. Assignments should be vocationally relevant; centres should consider the delivery of 'live projects' for example to support the vocational content of the unit and program.

## Unit 13: Multimedia Design and Authoring

**Unit code:** H/601/0467

**QCF Level 4:** BTEC Higher National

**Credit value:** 15

### ● Unit aim

To help learners understand design processes including planning, iteration and prototyping, in the context of building a multimedia product.

### ● Unit abstract

The interactive multimedia industry is one of the fastest moving sectors in the world. Those hoping to make a career in this sector will need to be able to produce high quality products. Creativity and imagination are key attributes of successful media designers, but learners must also acquire a firm grasp of the principles of interactive media design as well as good planning skills.

In this unit, learners will find out about the disciplines necessary to create a professional multimedia product. They will need to devise a design specification and build a prototype product. They will subsequently refine the product, further developing their initial ideas through an iterative process of development.

In completing this unit, learners will gain an understanding of how multimedia software applications can be used effectively as tools in a disciplined and structured design process aimed at producing a commercially usable prototype.

The unit will also teach learners how to focus on the needs of end users, to study who is likely to use the product they produce, and how to tailor what they are making to the user's needs.

### ● Summary of learning outcomes

**On successful completion of this unit a learner will:**

- 1 Understand the use of existing multimedia products
- 2 Know the importance of design discipline
- 3 Be able to apply design disciplines to a multimedia production
- 4 Be able to present a refined multimedia product prototype.

## Unit content

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### 1 Understand the use of existing multimedia products

*Research:* sources eg literature, publications, journals, electronic data, observation, questionnaire, interview, surveys

*Products:* types eg websites, interactive videos, DVDs, games, advertisements

### 2 Know the importance of design discipline

*Sensitivity:* cultural and contextual eg political, sexual, ethnic, minority groups, religious, cognitive and physical special needs, disabilities, discrimination awareness

*Human Computer Interaction (HCI):* testing eg formative, summative, quantitative, qualitative;

*User' needs:* requirements eg content, existing systems, environmental issues, location, social context, tasks constraints of a system, delivery platform; input, output devices

### 3 Be able to apply design disciplines to a multimedia production

*Task analysis:* observations eg task being performed, difficulties encountered, hesitations, question user expectations, question user requirements and opinions, visual perception, attention span, dexterity, memory constraints

*Prototype systems:* user-centred design eg storyboards, flow diagrams, scripts, musical scores; structure map; design standards and guidelines; copyright laws

*Develop:* improvements eg amend, edit, rearrange, replace

*Audio-visual:* types eg sound samples, animation, video, interactive elements

*Design:* layout eg quantity of information presented, grouping and prioritising of information, highlighting techniques, standardisation of screen display; features eg text, use of typography, graphics, screen metaphors, navigation systems, video, guides or agents, animation, visual feedback; accessibility eg prioritising, drawing attention, use of colour, language, dynamics of screen design, innovation, creativity; intrinsic and extrinsic rewards, feedback and playback

*Checking multimedia outcomes:* considerations eg completeness, accuracy, layout, formatting, animation, sound, sequence; review against requirements

*Editing multimedia outcomes:* customisations eg size, crop and position, proportion, colour schemes, font schemes, border styles, use layout guides; existing styles and schemes for font (typeface), size, orientation, colour, alignment

*Resolving problems:* sound eg sound-noise ratio, volume, clarity, accessibility, codec support; images eg levels, contrast, file size, proportions, placement, unwanted content; text eg clarity, spelling, grammar, structure

**4 Be able to present a refined multimedia product prototype**

*Originate:* source materials eg copyright licensing laws, scanned material, digital photography, digital video; cultural sensitivity, political propriety

*Presentation:* considerations; eg file size, format; constraints eg bandwidth, compression techniques; stand-alone applications eg screen-based, point of sale, educational, entertainment, information kiosk; CD-ROM pressing techniques; world wide web publishing

*Audience:* evaluate eg target users, computer users, non-computer literate users.

*Other considerations:* cross-platform file compatibility eg Macintosh file formats, Windows file formats; cross-platform performance eg file size, file economy, file quality, file compression techniques; browser eg browser friendly palettes, frames (Java), browser compatibility; assessing eg evaluating, checking, requirements, usability, accuracy



## Learning outcomes and assessment criteria

Learning outcomes  On successful completion of this unit a learner will:	Assessment criteria for pass  The learner can:
LO1 Understand the use of existing multimedia products	1.1 critically review examples of high and low quality multimedia products 1.2 discuss what makes a good quality multimedia product
LO2 Know the importance of design discipline	2.1 explain how the design process can be applied to a multimedia product 2.2 plan an iterative design process
LO3 Be able to apply design disciplines to a multimedia production	3.1 use an appropriate combination of resources and techniques to achieve multimedia outcomes 3.2 check multimedia outcomes meet needs 3.3 analyse own use of design discipline
LO4 Be able to present a refined multimedia product prototype	4.1 produce a working multimedia product prototype 4.2 present working multimedia product prototype to a multimedia professional 4.3 evaluate the prototype.

## Guidance

### Links to National Occupational Standards, other BTEC units, other BTEC qualifications and other relevant units and qualifications

The learning outcomes associated with this unit are closely linked with:

Level 3	Level 4	Level 5
Unit 43: Multimedia Design	Unit 11: Digital Media in Art and Design	Unit 37: Digital Image Creation and Development
	Unit 12: 2D, 3D, and Time-based Digital Applications	Unit 38: 3D Computer Modelling and Animation
	Unit 15: Website Management	

This unit has links to the Level 4 and Level 5 National Occupational Standards for IT and Telecoms Professionals, particularly the areas of competence of:

- Human Computer Interaction/Interface (HCI) Design.

### Essential requirements

Learners will need access to computer hardware with appropriate accessories such as scanners and printers, and to appropriate software such as Director, Flash, Dreamweaver, Fireworks, Adobe PhotoShop/Image Ready etc.

### Resources

#### Books

Andrews P – *Adobe PhotoShop Elements* (Adobe, 2009) ISBN 0321660323

Boyle T – *Design for Multimedia Learning* (Prentice Hall, 1996) ISBN 0132422158

Chapman Dr N and Chapman J – *Digital Multimedia* (John Wiley & Sons; 2009) ISBN 0470512164

Coupland K – *Web Works Navigation* (Rockport Publishers, 2000) ISBN 1564966623

Kalbach J – *Designing Web Navigation: Optimizing the User Experience* (O'Reilly Media, 2007) ISBN 0596528108

Gatter M – *Software Essentials for Graphic Designers: Photoshop, Illustrator, InDesign, QuarkXPress, Dreamweaver, Flash and Acrobat* (Laurence King, 2006) ISBN 1856694992

Kerman P – *Sams Teach Yourself Macromedia Flash MX in 24 Hours* (Sams, 2003) ISBN 0672325942

Maciuba-Koppel D – *The Web Writer's Guide* (Focal Press, 2003) ISBN 0240804813

Sengstack J – *Sams Teach Yourself Adobe Premiere in 24 hours* (Sams, 2004) ISBN 0672326078

**Websites**

[www.graphicssoft.about.com/od/findsoftware/a/businessmmedia.htm](http://www.graphicssoft.about.com/od/findsoftware/a/businessmmedia.htm)

[www.webstyleguide.com/wsg2/multimedia/design.html](http://www.webstyleguide.com/wsg2/multimedia/design.html)

**Employer engagement and vocational contexts**

Within this unit there are opportunities for tutors to support learners with their understanding of the range of hardware and software currently used as industrial standard. Many of these applications and hardware are now accessible to learners. Providing learners with access to relevant software manufacturers' manuals and other textbooks, the internet, and a range of examples of current multimedia practice should be encouraged.

This unit provides learners with the opportunity to gain knowledge of the styles and conventions of vocational areas such as graphic design, photography, post-production and production management.

Learners will have the opportunity to gain a fundamental knowledge of the creative technical and production practices such as understanding target audiences, copyright law, content production, graphic design, photography, typography, videography and moving image. This unit also presents opportunities for learners to understand wider vocational skills such as communication and planning and organisational skills.

Learners should be encouraged to learn and understand the importance of these principles in context with the work of professional practitioners across the creative arts vocational areas. This unit provides scope for learners to be engaged in 'real life' project briefs.

## Unit 14: Website Design

**Unit code:** J/601/1286

**QCF Level 4:** BTEC Higher National

**Credit value:** 15

### ● Aim

To enable learners to understand the concepts of website design and apply their own creativity in designing and developing interactive websites.

### ● Unit abstract

The internet is perhaps the most important IT development of the last few decades; it provides new ways to communicate and share information. It has also revolutionised the way people and businesses use IT.

Businesses can now take part in a global marketplace, widening their scope for potential customers, all from a local base and with relatively low start-up costs.

The need for good web designers and developers continues to grow as more and more companies realise they must develop a web presence and keep it maintained and updated.

As web technologies develop, there is an increasing need for websites to be interactive. This allows two-way communication between the user and the website.

The number of websites on the world wide web has increased dramatically and competition is very fierce. This means that designers must employ increasingly sophisticated techniques to capture interest, as well as ensuring that an appropriate company image is presented. Usability issues, such as navigation methods, must be considered carefully. A poorly-designed structure could result in users becoming confused or frustrated and navigating away from the website.

Learners will begin this unit by evaluating existing websites, in the context of cross-platforms, range of browsers, and design features. Designing websites, which are accessible to all types of users is a fundamental aspect of any website design.

This unit also considers the whole process from identification of need, design, implementation, testing, maintenance and review. It is important that learners do not just develop skills in specific techniques but are also able to select when and where they are most appropriate, basing this decision on client and user needs. As with any field of IT, a comprehensive understanding of the relevant legislation and guidelines is always fundamental.

● **Learning outcomes**

**On successful completion of this unit a learner will:**

- 1 Understand website design concepts
- 2 Be able to design interactive websites
- 3 Be able to implement interactive websites
- 4 Be able to test interactive websites.



## Unit content

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### 1 Understand website design concepts

*Users:* types eg expert, regular, occasional, novice, special needs; requirements eg psychological, cultural, social and environmental, health and safety, education and work

*Site analysis:* purpose eg communication, real-time information, commercial, government, education, business, entertainment, downloading/uploading, web storage; fit for purpose eg meets organisational and site objectives; planning eg storyboarding, structure, hypermedia linkage, search engine key words, graphical design, user interface, audio/video sources, animation, text design; maintenance eg plans, logs, disaster recovery, testing

*Accessibility:* features eg alternative text, resizable fonts, support for screen readers, adjustable fonts; current standards and legislation eg Disability Discrimination Act, Data Protection Act, e-Commerce Regulations Act, Computer Misuse Act, W3C validation, copyright and intellectual property rights

*Design:* rules and heuristics for good website design; accessibility; functionality eg timings, navigation, ease of use, user-friendliness; evaluation tools eg W3C Mark-up Validation Service

*Environment:* features eg Uniform Resource Locators (URL), Hypertext Mark-up Language (HTML), Dynamic Hypertext Mark-up Language (DHTML), Extensible Mark-up Language (XML), JavaScript, Java Applets, plug-ins, client and server-side scripting languages; multimedia eg animation, sound/visual effects; hardware and software requirements eg computer platforms, operating systems, application software; browser behaviour eg execute scripting languages, display Cascading Style Sheets (CSS), applets, Common Gateway Interface (CGI)

### 2 Be able to design interactive websites

*Identification of need:* nature of interactivity eg online transactions, static versus dynamic; client needs and user needs eg image, level of security, development timescales, maintenance contracts, costs, search engine visibility; end user need eg appropriateness of graphics, complexity of site, delivery of content

*Design tools:* concept designs eg mood boards, story boards; layout techniques eg frames, tables, block level containers, inline containers; templates; colour schemes; screen designs

### 3 Be able to implement interactive websites

*Structure:* layout of pages; navigation; format of content; Cascading Style Sheets (CSS); page elements, eg headings, rules, frames, buttons, text and list boxes, hyperlinks/anchors, graphical images, clickable images/maps; interactive features eg product catalogue, shopping cart; images and animation

*Content:* correct and appropriate; reliability of information source; structured for purpose eg prose, bullets, tables

*Development:* mark-up languages eg (HTML), (XHTML), (DHTML); client side scripting languages eg JavaScript, Visual Basic (VB) script; features and advantages of software languages; web authoring software tools

*Tools and techniques:* navigation diagram eg linear, hierarchy or matrix; building interactivity tools eg pseudo-code for client-server scripting; adding animation and audio/visual elements; ensuring compliance with W3C; meta-tagging; cascading style sheets

### 4 Be able to test interactive websites

*Review:* functionality testing (user environments, links and navigation); content; check user requirements; user acceptance; audit trail of changes

*Mechanisms:* types eg browser compatibility testing, platform testing, script-language testing; valid (HTML) code; checking functionality against requirements, check internal and external hyperlinks (web files, web documents, images), error detection, error messages, dry running

*Supportive documentation:* test plan; test results; programmer guidance; user guidance: on-screen help

## Learning outcomes and assessment criteria

Learning outcomes  On successful completion of this unit a learner will:	Assessment criteria for pass  The learner can:
LO1 Understand website design concepts	1.1 discuss the design concepts that have to be considered when designing a website
LO2 Be able to design interactive websites	2.1 design an interactive website to meet given requirements 2.2 evaluate website design with other users.
LO3 Be able to implement interactive websites	3.1 implement a fully-functional interactive website using a design specification.
LO4 Be able to test interactive websites	4.1 critically review and test the website 4.2 analyse actual test results against expected results to identify discrepancies 4.3 evaluate independent feedback and make recommendations for improvements 4.4 create onscreen help to assist the users 4.5 create documentation for the support and maintenance of the website.

## Guidance

### Links to National Occupational Standards, other BTEC units, other BTEC qualifications and other relevant units and qualifications

The learning outcomes associated with this unit are closely linked with:

Level 3	Level 4	Level 5
Unit 20: Client-side Customisation of Web Pages	Unit 13: Multimedia Design and Authoring	Unit 35: Web Applications Development
Unit 27: Web Server Scripting	Unit 15: Website Management	
Unit 28: Website Production		

This unit has links to the Level 4 and Level 5 National Occupational Standards for IT and Telecoms Professionals, particularly the areas of competence of:

- Human Computer Interaction/Interface (HCI) Design
- IT/Technology Infrastructure Design and Planning
- Software Development.

### Essential requirements

Learners must have access to facilities which will give them the opportunity to fully evidence all of the criteria in the unit.

Learners must evaluate a range of different websites, particularly focusing on design. Learners must be encouraged to identify strengths and weaknesses in the design, and discuss what methods they would use to improve the website. This will of course be taking into account accessibility, relevant legislation, usability, functionality, user friendliness, interface design, etc.

Legislation and accessibility are fundamental aspects of website design. Learners must be made aware of the range of legislation and standards, which have an impact on website design. Learners must understand the importance of legislation.

Learners must design and develop their own website. There are many different approaches to website design, all of which demonstrates how a website will be developed, what features and functions it will contain, the appearance, etc. Learners must be able to show that they can apply design skills first before developing a website.

Learners must have access to computing facilities, and web authoring tools to support them with the practical aspects of this unit. Learners must be given a range of activities with plenty of support, which will enable them to create HTML web pages. Further activities must be provided that will allow learners to embed a range of web functions, such as hyperlinks, tables, frames, colour, images, audio, video, etc. Learners must include client-side scripting such as JavaScript.

Evaluation and review continues to be an important theme of this unit, and learners must be encouraged to evaluate their work throughout the entire development process. Thorough testing must be performed on their website, to ensure that it is fit for purpose and meets the requirements/specification. Appropriate testing documentation must be used as a method of capturing test data, and demonstrating relevant testing.

## Resources

### Books

McFarland D – *CSS: The Missing Manual, second edition* (Pogue Press, 2009) ISBN 9780596802448

McFarland D – *Dreamweaver CS4: The Missing Manual* (Pogue Press, 2009) ISBN 9780596522926

McFarland D – *JavaScript: The Missing Manual*, first edition (Pogue Press, 2008)  
ISBN 9780596515898

Veer E – *Flash CS3: The Missing Manual* (Pogue Press, 2007) ISBN 9780596510442

### Websites

[www.thebestdesigns.com/](http://www.thebestdesigns.com/)

[www.w3.org](http://www.w3.org)

[www.w3schools.com](http://www.w3schools.com)

[www.webdesignfromscratch.com/articles-and-tutorials/](http://www.webdesignfromscratch.com/articles-and-tutorials/)

## Employer engagement and vocational contexts

Working with a local web design/development-based organisation or using internet-based open source projects would enhance the learners' experience and offer a relevant vocational context.





## Unit 15: Website Management

**Unit code:** R/601/1288

**QCF Level 4:** BTEC Higher National

**Credit value:** 15

### ● Aim

To enable learners to understand the concepts and knowledge required to effectively manage and maintain websites.

### ● Unit abstract

The work of the IT practitioner does not stop with the official handover of a website to a client. If it is to be successful, an organisation's website needs to be managed and kept up to date. Learners will understand what is involved in managing and monitoring the performance of a website once it has been published on the web and is accessible to a wide audience. They will investigate different types of web hosts and the services they offer by weighing up the benefits and drawbacks.

Learners will upload website files to a web server, as well as manage a range of web server management services. Once the website is published, learners will carry out and document routine maintenance activities and website reviews. They will monitor and assess site performance using statistics and visitor feedback.

There is no point in having a website if no one can find it. Most people use search engines as one method of finding information they need on the web. Learners will explore the different methods and techniques used to promote websites. They will also discover what features will enhance a website so that they retain visitors as well as create opportunities to welcome new visitors.

### ● Learning outcomes

**On successful completion of this unit a learner will:**

- 1 Understand the functions of website hosting
- 2 Be able to manage websites
- 3 Be able to improve website performance
- 4 Be able to promote websites.

## Unit content

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### 1 Understand the functions of website hosting

*Hosting:* methods eg website hosting, shared hosting, dedicated hosting, server co-location; hosting packages and services; domain names; costs; network uptime

*Functions:* services eg web management, email management, domain management, ftp management, file management, shopping cart, client support; performance eg reliability, availability, network uptime, access speeds, bandwidth; back-up; log analysis tools; security features

*Platforms:* operating systems eg Unix, Linux, Microsoft

*Scripting technologies:* server-side eg Hypertext Pre-Processor (PHP), Active Server Pages (ASP), ASP.NET, My-SQL (Structured Query Language) Common Gateway Interface (CGI)/ (Perl)

*Legislation:* accessibility, data protection, distance selling, privacy and electronic communications

### 2 Be able to manage websites

*Website:* structure eg files, folders, hypertext links; multimedia; web blogs; really simple syndication (RSS) feeds; pod casts; platform compatibility eg operating system, browser software, plug-ins; testing eg website files, links, browser, performance

*Upload:* methods eg internet, intranet, web server, File Transfer Protocol (FTP); file transfer protocol eg stand-alone FTP software, web-based FTP facilities, browser FTP capabilities; web authoring software; web server management; upload/download files (web pages, images, documents, multimedia content); directory structures; file and folder permissions eg read, write, execute; file security eg password protection; login, eg username, password; account control

*Maintenance:* content management, site integrity, troubleshooting eg broken hypertext links; monitor performance; implement upgrades; back-up

### 3 Be able to improve website performance

*Performance:* site structure; size and type of multimedia components; add-on components; bandwidth speed; network infrastructure; browser; computer hardware; computer software

*Popularity:* statistical data eg hit counter by day, month, year; traffic monitoring; visitor information eg visitor type, visit length; visitor feedback; website recognition eg awards, sponsorships; website accessibility; website promotion

*Tools:* hit counters, guest books/forums, statistics, feedback/comments forms

#### 4 Be able to promote websites

*Marketing:* advertising eg search engines, social networking, banner, pay-per-click; exchange website links; cross-marketing techniques eg letterheads, brochures, magazine, company vehicles, television, radio

*Visitors:* visitor incentives eg promotional/voucher codes, discounts; data security eg website certificates, secure socket layer (SSL), encryption; presentation eg multimedia, flash content, audio and visual components, human computer interaction (HCI); visitor feedback eg check boxes, radio buttons, drop-down menus, text fields, form to email, form to database

*Alternative methods:* off-the-shelf software, data entry forms, response facility, forums, free user groups

*Optimisations:* insert components eg title, description, keyword tags; client/server side script components eg dynamic hypertext mark-up language (DHTML), extensible hypertext mark-up language (XHTML), JavaScript, Perl, Hypertext Pre-Processor (PHP), Active Server Pages (ASP), ASP.NET, Cascading Style Sheets (CSS); enhancements eg rollover image maps, audio/visual, drop-down menus, colours, multimedia

## Learning outcomes and assessment criteria

Learning outcomes  On successful completion of this unit a learner will:	Assessment criteria for pass  The learner can:
LO1 Understand the functions of website hosting	1.1 explain the methods and techniques required to host a website 1.2 evaluate the different services offered by web host providers 1.3 explain the legal requirements of hosting an online website.
LO2 Be able to manage websites	2.1 demonstrate the upload of a website to a web server 2.2 perform website maintenance to sustain maximum efficiency and performance
LO3 Be able to improve website performance	3.1 discuss how to monitor the performance of a website 3.2 analyse statistics relating to visitors accessing a website 3.2 explain the methods and techniques used to gather visitor feedback for a website
LO4 Be able to promote websites	4.1 explain the methods and techniques required to promote a website 4.2 evaluate the different features that are available to enhance and upgrade a website.



## Guidance

### Links to National Occupational Standards, other BTEC units, other BTEC qualifications and other relevant units and qualifications

The learning outcomes associated with this unit are closely linked with:

Level 3	Level 4	Level 5
Unit 20: Client-side Customisation of Web Pages	Unit 14: Website Design	Unit 35: Web Applications Development
Unit 27: Web Server Scripting		
Unit 28: Website Production		

This unit has links to the Level 4 and Level 5 National Occupational Standards for IT and Telecoms Professionals, particularly the areas of competence of:

- IT/Technology Infrastructure Design and Planning
- Software Development
- IT/Technology Service Operations and Event Management
- IT/Technology Management and Support.

### Essential requirements

Learners must have access to appropriate web-hosting software. They must also have access to software that enables them to upload a website.

This unit will provide learners with the opportunity to upload and manage a website, either by developing their own website, or using a website developed in other units.

Learners must be able to publish their website using a web-hosting service or local intranet system controlled by the centre.

Learners must begin this unit by exploring the vast array of website hosting packages, and the range of services they provide. It will be useful to compare these services with other web hosting packages, particularly in terms of cost, performance, reliability, and other critical factors.

Learners must be aware of the legal requirements for hosting a website, where content is accessible to everyone.

A web server can be a complicated system to use. Centres must demonstrate the full functions of using a web host/server, including uploading/downloading files, setting appropriate folder/file permissions (access privileges) as well as other features. Learners must analyse statistics on their website.

Learners must be encouraged to explore a range of methods and techniques, which will help promote websites. There is a vast array of online services, which are designed to help promote and advertise websites.

## Resources

### Books

Elliot G – *Website Management* (Lexden Publishing Limited, 2007) ISBN 9781904995210

Thompson P – *Website Essentials: A Guide to Planning, Designing and Managing Your Website* (Frogeye Publications, 2006) ISBN 0955304008

### Websites

<http://archive.cabinetoffice.gov.uk/e-government/resources/handbook/html/1-2.asp>

[www.wdvl.com/WebRef/Tools/](http://www.wdvl.com/WebRef/Tools/)

## Employer engagement and vocational contexts

Working with a local web design/development-based organisation or using internet-based open source projects would enhance the learners' experience and offer a relevant vocational context.

## Unit 16: e-Commerce Technologies

**Unit code:** K/601/1975

**QCF Level 4:** BTEC Higher National

**Credit value:** 15

### ● Aim

The aim of this unit is to give learners an understanding of the functionality and technology that underpin e-Commerce solutions.

### ● Unit abstract

E-Commerce has become one of the biggest growth areas in recent years. Almost everybody has engaged with buying and selling over the internet. This includes individual consumers purchasing or trading online, through to retailers that have extended their business provision to include a website and online presence, reaching out to a global market.

This unit begins by exploring a commercial transactional website, beginning with the front-end services and investigating how this links to back-office processes such as data management systems. The technologies involved in running an e-Commerce solution are explored including web architecture, hardware and software requirements and communication technology features which ensure the smooth running of the site..

Security forms a major part of any e-Commerce solution and this unit explores the various methods of securing the site, data and online payments as customers purchase goods from the site. Finally, learners will design an e-Commerce solution for a small to medium e-Commerce organisation.

On completion of this unit learners will have an understanding and appreciation of e-Commerce technologies, and how they support the infrastructure of e-Commerce activities and trading.

### ● Learning outcomes

**On successful completion of this unit a learner will:**

- 1 Understand the functionality of commercial transactional websites
- 2 Understand the technologies involved in setting up commercial websites
- 3 Know how to address e-Commerce security issues
- 4 Be able to design e-Commerce technology solutions.

## Unit content

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### 1 Understand the functionality of commercial transactional websites

*Purpose of site:* purposes eg how it is structured, the goods and/or services offered, product information provided, types of transactions that can be made and how easy it is to do so, methods used to capture customer information (both overt and covert), customer authentication, techniques used to engage, retain and entice customers, usability and accessibility

*Services:* benefits eg access to a world wide customer base, low set-up and running costs, extension of product range to include internet-specific goods and services, 24 x 7 presence, faster response times, real-time sales information, customer expectation.

*Data:* processes eg capture and process data, present and exchange information, conduct transactions, market goods and services, distribute goods, manage customer relations, optimise just-in-time purchasing of stock and components; transactional database eg products and prices, stock levels, customers, orders.

*Back office processes:* activities eg maintenance of the virtual shopping basket, identification and authentication routines, real-time tracking of customers' actions, payment processing, stock control, despatch and delivery; chain of events leading up to an online purchase; chain of events that an online purchase triggers

### 2 Understand the technologies involved in setting up commercial websites

*Web architecture:* components eg Server-side scripting, client/server/script interaction, operation of server-side web applications, accessing data on the web server, dynamic web pages, consistent navigational menu on all pages, browser cookies, embedding animation and video content in web pages, adding interactivity with plug-ins

*Technology:* hardware and software eg web servers, browsers, server software, web authoring tools, database system, shopping cart software, scripting software, browser and platform compatibility

*Networking technology* eg TCP/IP addresses, ports and protocols; domain names, multiple registration of domains (.com as well as .co.uk); setting up the server directory structure, deploying access configuration/security

*Database:* uses and processes eg database-driven web pages, opening a connection to a database, storing data captured from forms, performing dynamic queries on the database, generating a web page response displaying the results of a query

*Data transmission:* features eg download speeds, transfer rates, bandwidth required for given applications including text, graphics, video, speech

*Communication technology:* uses eg email support, forum; search engine optimisation; additional hardware and software components required to support communications

### 3 Know how to address e-Commerce security issues

*Protection from security threats:* methods eg risk assessment, physical security, user identification and access rights, firewalls, virus protection, managing software updates, restricting HTTP methods, securing communication with SSL/TLS, enabling HTTPS on the web server, protecting the exchange of credentials, Secure Electronic Transactions (SET), detecting unauthorised modification of content, configuring permissions correctly, scanning for file-system changes

*Certification:* procedures eg obtaining and installing server certificates, certificate chains/hierarchies, validation; security eg public- and private-key cryptography, verifying message integrity with message digests, digital signatures and digital certificates

*Customer information:* handling eg how it is protected, how accurate it is, what it is being used for, who has access to it, potential threats such as identity theft and fraud.

*Legislation:* with respect to organisations and individuals exchanging information and conducting transactions online eg data protection, civil rights, distance selling

### 4 Be able to design e-Commerce technology solutions

*Solution:* design for a small to medium e-Commerce organisation

*Hosting:* choice of Internet Service Provider (ISP); in house or sub-contracted

*Hardware and software:* requirements based on eg projected hits on site, bandwidth requirements

*Structure:* customer interface eg ease of use, display of products, personal details entry, credit card entry, other types of payment, delivery details; image; style

*Promotion:* marketing: eg advertising the site, placing in search engines; message board; chat rooms

*Finance:* costs eg hardware and software, setup, maintenance, security, leasing, advertising; delivery strategy; staff training

*Security:* fraud protection; threats eg hackers, viruses

*Database:* processes eg schema design, query processing, file systems, ensuring integrity, availability, successful transactions, recovery and authentication; multimedia databases

*Connectivity:* linking via a web server/internet with databases eg ODBC (Object Database Connectivity), JDBC (Java Database Connectivity (DBC)), SQL, Microsoft ASP (Active Server Pages)



## Learning outcomes and assessment criteria

Learning outcomes On successful completion of this unit a learner will:	Assessment criteria for pass The learner can:
LO1 Understand the functionality of commercial transactional websites	1.1 evaluate the effectiveness of a commercial transactional website suggesting areas for improvement 1.2 show diagrammatically the chain of events and the flow of information that are triggered by an online purchase
LO2 Understand the technologies involved in setting up commercial websites	2.1 analyse a commercial transactional website detailing the technologies implemented by the site 2.2 explain how to evaluate web server performance
LO3 Know how to address e-Commerce security issues	3.1 discuss how the security of data exchanged through an e-Commerce service can be managed 3.2 describe current legislation related to online purchasing and protection of customer data
LO4 Be able to design e-Commerce technology solutions	4.1 design an e-Commerce technology solution for a small to medium e-Commerce organisation 4.2 discuss the differences between an in-house hosted solution against a sub-contracted hosted solution.

## Guidance

### Links to National Occupational Standards, other BTEC units, other BTEC qualifications and other relevant units and qualifications

The learning outcomes associated with this unit are closely linked with:

Level 3	Level 4	Level 5
Unit 3: Information Systems	Unit 1: Business Skills for e-Commerce	Unit 29: e-Commerce Strategy
Unit 8: e-Commerce		Unit 30: Information Systems in Organisations
Unit 33: Exploring Business Activity		
Unit 34: Business Resources		

This unit has links to the Level 4 and Level 5 National Occupational Standards for IT and Telecoms Professionals, particularly the areas of competence of:

- IT/Technology Infrastructure Design and Planning.

### Essential requirements

Learners must have access to a range of e-Commerce sites and organisations that engages with e-Commerce at all levels. Learners should also keep up to date with current research developments in the field regarding technologies and security.

### Resources

#### Books

Hassler V – *Security Fundamentals for E-commerce* (Artech House, 2000) ISBN 1580531083

Khosrow-Pour M – *E-commerce Security: Advice from Experts (IT Solutions)* (IGI Publishing, 2004) ISBN-10: 1591402417

Reynolds J – *The Complete E-Commerce Book: Design, Build & Maintain a Successful Web-based Business: Design, Build and Maintain a Successful Web-based Business* (CMP, 2004) ISBN-10: 1578203120

Rich J – *Design and Launch an e-Commerce Business in a Week (Entrepreneur Magazine's Click Starts)* (Entrepreneur Press, 2008) ISBN-10: 1599181835

### Websites

<http://forums.techarena.in/guides-tutorials/6050.htm>

[www.ecommerce-digest.com/ecommerce-security-issues.html](http://www.ecommerce-digest.com/ecommerce-security-issues.html)

[www.ecommercetechnology.org/english/index.htm](http://www.ecommercetechnology.org/english/index.htm)

### Employer engagement and vocational contexts

To further enrich the content of this unit and to provide more of a vocational context it would be beneficial to bring in guest speakers from a range of organisations. Speakers can discuss their e-Commerce system(s) in terms of the infrastructure, technologies and security aspects.

## Unit 17: Database Design Concepts

**Unit code:** R/601/0447

**QCF Level 4:** BTEC Higher National

**Credit value:** 15

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- **Aim**

To give learners opportunities to develop an understanding of the concepts and issues relating to databases and database design as well as the practical skills to translate that understanding into the design and creation of complex databases.

- **Unit abstract**

Databases play an integral part in commercial domains, they provide users with a tool in which to store, model and retrieve data. Database development is fundamental in the area of computing and ICT within organisational contexts. Database Management Systems (DBMS) provide the systems, tools and interfaces by which the organisation can manage their information and use it to assist in the effective running of the organisation. Databases offer many links to other areas such as programming, systems analysis, HCI, as well as embracing issues of compatibility and end-user interfacing.

This unit explores database architecture, DBMS and the use of databases in an organisational context. Database design techniques are investigated and successful learners will be able to apply theoretical understanding to design, create and document a database system.

- **Learning outcomes**

**On successful completion of this unit a learner will:**

- 1 Understand databases and data management systems
- 2 Understand database design techniques
- 3 Be able to design, create and document databases.

## Unit content

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### 1 Understand databases and data management systems

*Databases:* database architectures; files and record structures; physical and logical views of data; advantages of using databases; reduction of data redundancy; data consistency (validity, accuracy, usability and integrity); independence of data; data sharing possibilities; security; enforcement of standards; database utilities; data dictionaries; query languages; report generators

*Databases in an organisational context:* database applications; role of the database administrator; key organisational issues eg integrity, security, recovery, concurrency; industry standards eg Microsoft SQL, Oracle, Sybase, dBase

*Database Management Systems (DBMS):* structures; purposes; features and advantages; applications; methods of data organisation and access

### 2 Understand database design techniques

*Database design methods and methodology:* requirements analysis; database designer working with expert in domain development area; requirement specification; logical design eg relational databases, tables; physical design eg data elements, data types, indexes; data analysis and design within systems analysis; database design within a system development methodology

*Relational database design:* tables, relations, primary/foreign/compound keys; entity-relationship modelling; normalisation theory to third normal form

### 3 Be able to design, create and document databases

*Database development cycle:* developing logical data model; implementing a physical data model based on the logical data model; testing the physical data model; comparing model with requirements analysis; user interface eg input masks, drop-down lists, option buttons, command buttons

*Database software:* using appropriate applications software, eg Microsoft Access, SQL; database tools eg create tables, add new rows, alter data, functions, relational database languages

*Tools and techniques:* field and table design; validation and verification techniques; forms including such features as dropdown lists or check boxes; reports; queries; macros

*Documentation:* technical documentation; user documentation



## Learning outcomes and assessment criteria

Learning outcomes  On successful completion of this unit a learner will:	Assessment criteria for pass  The learner can:
LO1 Understand databases and data management systems	1.1 analyse the key issues and application of databases within organisational environments 1.2 critically evaluate the features and advantages of database management systems
LO2 Understand database design techniques	2.1 analyse a database developmental methodology 2.2 discuss entity-relationship modelling and normalisation
LO3 Be able to design, create and document databases	3.1 apply the database developmental cycle to a given data set 3.2 design a fully functional database (containing at least four inter-relational tables) including user interface 3.3 evaluate the effectiveness of the database solution and suggest methods of improvement 3.4 provide supporting user and technical documentation.

## Guidance

### Links to National Occupational Standards, other BTEC units, other BTEC qualifications and other relevant units and qualifications

The learning outcomes associated with this unit are closely linked with:

Level 3	Level 4	Level 5
Unit 18: Database Design	Unit 9: Systems Analysis and Design	Unit 33: Data Analysis and Design

This unit has links to the Level 4 and Level 5 National Occupational Standards for IT and Telecoms Professionals, particularly the areas of competence of:

- Data Analysis.

### Essential requirements

Learners must have access to database software such as Microsoft Access or industry standard software, as learners can then transfer any skills and knowledge and map it directly into a commercial environment.

This unit must be divided into taught theory and practical sessions. In developmental activities, learners must be encouraged to develop designs and then be given feedback prior to any actual implementation – errors and confusions within a database design can cause significant problems at implementation that are difficult to retrieve.

Learners must make connections and identify the role of database design within the systems development lifecycle.

Learners must be introduced to developmental methodologies such as Structured Systems Analysis and Design Methodology (SSADM), Rapid Application Development (RAD) and the SPIRAL software development process.

## Resources

### Books

Avison D and Fitzgerald G – *Information Systems Development: Methodologies, Techniques and Tools* (McGraw Hill Higher Publishing Company, 2006) ISBN 0077114175

Chao L – *Database Development and Management* (CRC Press, 2006) ISBN 0849392381

Connolly T and Begg C – *Database Systems: A Practical Approach to Design, Implementation and Management* (Addison Wesley, 2004) ISBN 0321210255

Howe D – *Data Analysis for Database Design* (Butterworth-Heinemann Ltd, 2001) ISBN 0750650869

Kroenke D – *Database Concepts, 2nd Edition* (Prentice Hall, 2004) ISBN 0131451413

Ritchie C – *Relational Database Principles* (Thomson Learning, 2002) ISBN 0826457134

### Websites

[www.deeptraining.com/litwin/dbdesign/FundamentalsOfRelationalDatabaseDesign.aspx](http://www.deeptraining.com/litwin/dbdesign/FundamentalsOfRelationalDatabaseDesign.aspx)

[www.geekgirls.com/menu\\_databases.htm](http://www.geekgirls.com/menu_databases.htm)

[www.smart-it-consulting.com/database/progress-database-design-guide/](http://www.smart-it-consulting.com/database/progress-database-design-guide/)

## Employer engagement and vocational contexts

To further enrich the content of this unit and to provide more of a vocational context it would be beneficial to bring in guest speakers, such as database designers, end users and administrators to discuss their role within an organisation(s) and the importance of good database design.



## Unit 18: Procedural Programming

**Unit code:** D/601/1293

**QCF Level 4:** BTEC Higher National

**Credit value:** 15

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- **Aim**

To provide learners with an understanding of the principles of procedural programming and to enable them to design and implement procedural programming solutions.

- **Unit abstract**

Irrespective of framework or delivery platform, the development of procedural code is still at the core of many commercial application development projects. Event driven systems and object oriented platforms all use procedural code for the critical command content of their objects, events and listeners.

This unit allows learners to become familiar with the underpinning principles of procedural programming. Many languages have the capacity to develop procedural code and it is not important which language is chosen for this unit.

Ideally, for learners who are new to programming, this unit would be considered the starting point before progressing onto one (or all) of the many programming units. Whilst the learner is not expected to develop any complex code in this unit, the foundations will enable the development of their programming skills.

- **Learning outcomes**

**On successful completion of this unit a learner will:**

- 1 Understand the principles of procedural programming
- 2 Be able to design procedural programming solutions
- 3 Be able to implement procedural programming solutions
- 4 Be able to test procedural programming solutions.



## Unit content

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### 1 Understand the principles of procedural programming

*Characteristics of programming:* low-level languages; high-level languages; generations eg first, second, third, fourth, fifth; programs; applications; instructions; algorithms

*Types of language:* procedural languages; object-oriented; event-driven; others eg script and mark-up languages; simple overviews and uses

*Reasons for choice of language:* organisational policy; suitability of features and tools; availability of trained staff; reliability; development and maintenance costs; expandability

*Data structures:* variables eg naming conventions, local and global variables, arrays (one-dimensional, two-dimensional); file structures; loops eg conditional (pre-check, post-check, break-points), fixed; conditional statements; case statements; logical operators; assignment statements; input statements; output statements

*Data types:* constants and literals; integer; floating point; byte; date; boolean; others eg character, string, small int; choice of data types eg additional validation, efficiency of storage

*Programming syntax:* command rules, variable declaration, *Standards:* use of comments, code layout, indentation

### 2 Be able to design procedural programming solutions

*Requirements specification:* inputs, outputs, processing, user interface; constraints eg hardware platforms, timescales for development; units; data; file structures.

*Program design:* tools eg structure diagrams, data flow diagrams, entity relationship models, flow charts, pseudo code

*Technical documentation:* requirements specification; others as appropriate to language eg form design, flowcharts, pseudo code, structured English, action charts, data dictionary, class and instance diagrams

### 3 Be able to implement procedural programming solutions

*Modular design:* elements eg functions, procedures, method, widgets, Graphical User Interface (GUI) components, symbols

*Software structures:* as appropriate to language chosen eg iteration, decisions, units, functions, procedures; control structures; conditional commands

*Parameters:* data types, passing data, return values

*Scope of variables:* global, local, static, overloaded results, instance

*Programming:* use of programming standards; relationship to program design

#### 4 Be able to test procedural programming solutions

*Mechanisms:* valid declarations, debugging code, checking naming conventions; checking functionality against requirements, error detection, error messages, compiler errors, runtime errors, in code response, dry running

*Supportive documentation:* test plan; test results; programmer guidance; user guidance; onscreen help

*Review:* design against specification requirements, interim reviews

## Learning outcomes and assessment criteria

Learning outcomes  On successful completion of this unit a learner will:	Assessment criteria for pass  The learner can:
LO1 Understand the principles of procedural programming	1.1 discuss the principles, characteristics and features of procedural programming
LO2 Be able to design procedural programming solutions	2.1 identify the program units and data and file structures required to implement a given design 2.2 design a procedural programming solution for a given problem
LO3 Be able to implement procedural programming solutions	3.1 select and implement control structures to meet the design algorithms 3.2 correctly use parameter passing mechanisms 3.3 implement a procedural programming solution based on a prepared design
LO4 Be able to test procedural programming solutions	4.1 critically review and test a procedural programming solution 4.2 analyse actual test results against expected results to identify discrepancies 4.3 evaluate independent feedback on a developed procedural programme solution and make recommendations for improvements 4.4 create onscreen help to assist the users of a computer program 4.5 create documentation for the support and maintenance of a computer program.

## Guidance

### Links to National Occupational Standards, other BTEC units, other BTEC qualifications and other relevant units and qualifications

The learning outcomes associated with this unit are closely linked with:

Level 3	Level 4	Level 5
Unit 6: Software Design and Development	Unit 19: Object Oriented Programming	Unit 35 Web Applications Development
Unit 14: Event Driven Programming	Unit 20: Event Driven Programming Solutions	Unit 39: Computer Games Design and Development
Unit 15: Object Oriented Programming	Unit 21: Software Applications Testing	Unit 40: Distributed Software Applications
Unit 16: Procedural Programming	Unit 22 Office Solutions Development	Unit 41: Programming in Java
	Unit 23: Mathematics for Software Development	Unit 42: Programming in .NET

This unit has links to the Level 4 and Level 5 National Occupational Standards for IT and Telecoms Professionals, particularly the areas of competence of:

- Software Development.

### Essential requirements

Whilst some procedural languages are commercially available, there are also free languages available incorporating a diverse range of commands, commonly deployed on many platforms. Centres must ensure that in the case of mobile platforms the applicable free emulators are available or where security policies dictate, local work stations are equipped with virtualised operating systems containing the programming environment.

Learners must have access to facilities, which allow them the opportunity to fully evidence all of the criteria of the unit. If this cannot be guaranteed then centres should not attempt to deliver. The learner must develop a procedural program that can work on a range of platforms, therefore it may be command line, web based, Graphical User Interface (GUI) based, games console or a deliverable for a mobile platform amongst many other solutions.

To ensure success centres must keep the delivery to one language. However, as many procedural languages now allow development in multiple platforms, learners may access this if it is locally realistic.

Centres must use a range of design methodologies, ensuring that the method selected is suited to the environment selected as well as the programming language of choice.

Implementation must be based on a suitably structured problem that ensures the use of modular elements, control structures and conditional commands.

Centres must select a programming activity, or use an external source (employer, commissioner, open source). The design of the programming solution does not need to be a standalone application and may be an enhancement or extension to existing work.

## **Resources**

### **Books**

Davis S R – *C++ for Dummies* (Wiley, 2009) ISBN-10: 0470317264

McBride P K – *Turbo Pascal Programming Made Simple* (Made Simple, 1997) ISBN 0750632429

McGrath M – *C Programming in Easy Steps* (In Easy Steps Limited, 2009) ISBN 184078363X

Parkin A and Yorke R – *Cobol for Students* (Butterworth Heinemann, 1995) ISBN 0340645520

### **Websites**

<http://library.thinkquest.org/27297/>

[www.cplusplus.com/doc/tutorial/](http://www.cplusplus.com/doc/tutorial/)

[www.cprogramming.com/](http://www.cprogramming.com/)

[www.csis.ul.ie/cobol/](http://www.csis.ul.ie/cobol/)

## **Employer engagement and vocational contexts**

Working with a local programming-based organisation or using internet-based open source projects would enhance the learners' experience and offer a relevant vocational context.



## Unit 19: Object Oriented Programming

**Unit code:** K/601/1295

**QCF Level 4:** BTEC Higher National

**Credit value:** 15

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### ● Aim

To provide learners with an understanding of the principles of object oriented programming as an underpinning technological concept in the field of programming, data management and systems development.

### ● Unit abstract

Object oriented programming is an industry-proven method for developing reliable modular programs and is popular in software engineering and systems development. Consistent use of object oriented techniques can lead to shorter development life cycles, increased productivity, adaptable code, reuse of different technologies, the interaction of different systems using common platforms and therefore lower the cost of producing and maintaining systems.

The development of systems with objects simplifies the task of creating and maintaining complex applications. Object oriented programming is a way of modelling software that maps programming code to the real world.

In terms of impact, object oriented technology can be found in many systems, from commercial operating systems to mobile phones and in many multimedia applications. The majority of programming languages are object oriented in focus, with the exceptions preferring to offer specialist programming resources. It is dominant in Visual Studio, C++, Java, the Microsoft .Net environment, Action Script and many other systems.

Learners taking this unit will have the opportunity to develop their understanding of the object oriented paradigm and develop code suited to a range of platforms using the object oriented methodology.

### ● Learning outcomes

**On successful completion of this unit a learner will:**

- 1 Understand the principles of object oriented programming
- 2 Be able to design object oriented programming solutions
- 3 Be able to implement object oriented programming solutions
- 4 Be able to test and document object oriented programming solutions.

## Unit content

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### 1 Understand the principles of object oriented programming

*Characteristics of objects:* types eg constructors, destructors; classification; features eg inheritance, polymorphism, encapsulation, public classes, private classes, public methods, private methods, message passing; interpreted, open source, common libraries

*Variables:* public instance variables; private instance variables; static references

*Software engineering:* features eg modularity, encapsulation, reuse, method overloading, instance variables, classes, abstract classes, interfaces

*Classes:* characteristics eg identification attributes, control of scope of attributes and methods, inheritance, aggregation, association, polymorphism

### 2 Be able to design object oriented programming solutions

*Development:* selection eg identification of programming language, identification of programming libraries, selection of development environment

*Design methodology:* options eg reuse of existing system, adaptation of code, use of open source

*Design method:* tools eg class responsibilities collaboration cards, class diagram, identification of dependencies and inheritances, data and file structures.

*System delivery:* style eg scripted, interpreted, compiled

*Programming platform:* types eg GUI, script, command line

*Delivery environment:* types eg mobile, handheld, web based, desktop, dedicated device

*Interaction:* considerations eg exchange of data with other systems, compliance, compatibility, recognition of standards employed

*Design refinement:* clarification of a design using principles of maximum coherence and minimum coupling between the classes

### 3 Be able to implement object oriented programming solutions

*Coding:* use of conventional language commands; pre-defined eg class library, downloaded, imported, reversion code

*Control structures:* types eg subroutines, branching, iteration, interrupts, signals

*Complexity:* inclusion of eg multiple classes, application of inheritance in created code, reuse of objects

*IDE:* typical elements eg source code editor, compiler, interpreter, build automation tools, debugger

#### 4 **Be able to test and document object oriented programming solutions**

*Testing:* mechanisms eg valid declarations, debugging code, comment code, naming conventions, checking functionality against requirements; documentation

*Errors:* handling eg management of extremes, use of system imposed statements

*Impact testing:* types eg range testing, input testing, load testing, system compatibility

*Onscreen help:* methods eg pop-ups, help menu, hot-spots

*Documentation:* technical documentation to include eg designs, delivery system, platform, environment, file structures, coding, constraints, maintenance requirements

## Learning outcomes and assessment criteria

Learning outcomes  On successful completion of this unit a learner will:	Assessment criteria for pass  The learner can:
LO1 Understand the principles of object oriented programming	1.1 discuss the principles, characteristics and features of objected oriented programming
LO2 Be able to design object oriented programming solutions	2.1 identify the objects and data and file structures required to implement a given design 2.2 design an object oriented programming solution to a given problem
LO3 Be able to implement object oriented programming solutions	3.1 implement an objected oriented solution based on a prepared design 3.2 define relationships between objects to implement design requirements 3.3 implement object behaviours using control structures to meet the design algorithms 3.4 make effective use of an Integrated Development Environment (IDE), including code and screen templates
LO4 Be able to test and document object oriented programming solutions	4.1 critically review and test an object orientated programming solution 4.2 analyse actual test results against expected results to identify discrepancies 4.3 evaluate independent feedback on a developed object oriented programme solution and make recommendations for improvements 4.4 create onscreen help to assist the users of a computer program 4.5 create documentation for the support and maintenance of a computer program.

## Guidance

### Links to National Occupational Standards, other BTEC units, other BTEC qualifications and other relevant units and qualifications

The learning outcomes associated with this unit are closely linked with:

Level 3	Level 4	Level 5
Unit 6: Software Design and Development	Unit 18: Procedural Programming	Unit 35: Web Applications Development
Unit 14: Event Driven Programming	Unit 20: Event Driven Programming Solutions	Unit 39: Computer Games Design Development
Unit 15: Object Oriented Programming	Unit 21: Software Applications Testing	Unit 40: Distributed Software Applications
Unit 16: Procedural Programming	Unit 22: Office Solutions Development	Unit 41: Programming in Java
	Unit 23: Mathematics for Software Development	Unit 42: Programming in .NET

This unit has links to the Level 4 and Level 5 National Occupational Standards for IT and Telecoms Professionals, particularly the areas of competence of:

- Software Development.

### Essential requirements

Many of the object oriented programming languages are free and accessible. Centres may need to ensure that in the case of mobile platforms the applicable free emulators are available or where security policies dictate, local workstations are equipped with virtualised operating systems containing the programming.

Learners must have access to facilities, which allow them the opportunity to fully evidence all of the criteria of the unit. If this cannot be guaranteed then centres should not attempt to deliver this unit.



**Resources****Books**

Kaldahl B – *EZ Flash MX: Animation, Action Script and Gaming for Macromedia Flash* (Trafford Publishing, 2004) ISBN 1412006171

Lemay L and Cadenhead R – *Sams Teach Yourself Java 2 in 21 Days, 4th Edition* (Sams, 2004) ISBN 0672326280

Schildt H – *C++: A Beginner's Guide, 2nd Edition* (McGraw-Hill Education, 2003) ISBN 0072232153

Templeman J and Olson A – *Microsoft Visual C++ .NET Step by Step: Version 2003* (Microsoft Press US, 2003) ISBN 0735619077

**Websites**

<http://java.sun.com/docs/books/tutorial/>

<http://msdn.microsoft.com/en-us/visualc/default.aspx>

**Employer engagement and vocational contexts**

Working with a local programming-based organisation or using internet-based open source projects would enhance the learners' experience and offer a relevant vocational context.

## Unit 20: Event Driven Programming Solutions

**Unit code:** H/601/0453

**QCF Level 4:** BTEC Higher National

**Credit value:** 15

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- **Aim**

To provide learners with an understanding of the principles of event driven programming as an underpinning technological concept in the fields of programming and systems development.

- **Unit abstract**

Unlike traditional programming, where the flow of control is determined by the program structure and the programmers design, the control in event driven programs is largely driven by external events and is often determined by interaction with the user. Typically, the systems involved employ pre-programmed event loops (or listeners) to continually look for information to process.

Event driven programming is a very flexible way of allowing programs to respond to many inputs or events. It is used for all GUI based applications and can be found in web based multimedia as well as mobile technologies.

This unit allows learners to become familiar with the underpinning concepts of event driven programming and subsequently to develop particular skills in one chosen language. A variety of languages have the capacity to develop event driven solutions and it is not important which language is chosen as long as the skills being developed and evidenced relate to the key event driven focus.

As with all programming, a focus on developing solutions to meet identified needs is made along with one that emphasises the importance of testing and reviewing.

- **Learning outcomes**

**On successful completion of this unit a learner will:**

- 1 Understand the principles of event driven programming.
- 2 Be able to design event driven programming solutions
- 3 Be able to implement event driven programming solutions
- 4 Be able to test and document event driven programming solutions.

## Unit content

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### 1 Understand the principles of event driven programming

*Characteristics:* key characteristics eg event handlers, listeners, trigger functions, event loops, forms

*Features:* key features eg flexibility, suitability for Graphical User Interface (GUI) environments, simplicity of programming, ease of development, potential portability

*Programming languages:* available languages eg Visual Studio .Net environment, Action Script, Java, C++

*Development environments:* environments eg for a given GUI, Java Runtime, mobile phones, multimedia, web based

### 2 Be able to design event driven programming solutions

*Development:* selection eg identification of programming language, identification of programming libraries, selection of development environment

*Design methodology:* options eg reuse of existing system, adaptation of code, use of open source

*Design method:* tools eg GUI template, graphical interface, design guides, state and interaction diagrams, screen layouts, data storage event procedures and descriptions, data and file structures

*Specification:* contents eg input, output, processes, user need, purpose

*Creation of application:* use of development environment eg mobile, handheld, web based, desktop, dedicated device; debugging delivery environment

*Interaction:* considerations eg exchange of data with other systems, compliance, compatibility, recognition of standards employed

### 3 Be able to implement event driven programming solutions

*Triggers:* types eg key press, alarm, system event, touch screen event, mouse click, external trigger, network event, incoming data, incoming call, Global Positioning Systems (GPS) data change

*Tools and techniques:* tools eg use of tool boxes and controls, debugging tools; techniques eg selection, loops, event handlers, triggers, listeners, objects and object properties, menus

*Data:* properties eg variables, data types, declaring variables, scope of variables, constants

*Programming:* coding eg use of methods, use of 'traditional coding'

*Control structures:* types eg subroutines, branching, interrupts, signals

*Complexity:* multiple events; user interaction

*Errors:* handling eg management of extremes, use of system imposed statements

*IDE:* typical elements eg source code editor, compiler, interpreter, build automation tools, debugger

#### 4 **Be able to test and document event driven programming solutions**

*Testing:* mechanisms eg valid declarations; debugging code; comment code; naming conventions; checking functionality against requirements; documentation

*Impact testing:* types eg range testing, input testing, load testing, system compatibility

*Onscreen help:* methods eg pop-ups, help menu, hot-spots

*Documentation:* technical documentation to include eg designs, delivery system, platform, environment, file structures, coding, constraints, maintenance requirements

## Learning outcomes and assessment criteria

Learning outcomes  On successful completion of this unit a learner will:	Assessment criteria for pass  The learner can:
LO1 Understand the principles of event driven programming	1.1 discuss the principles, characteristics and features of event driven programming
LO2 Be able to design event driven programming solutions	2.1 design an event driven programming solution to a given problem 2.2 identify the screen components and data and file structures required to implement a given design
LO3 Be able to implement event driven programming solutions	3.1 implement an event driven solution based on a prepared design 3.2 implement event handling using control structures to meet the design algorithms 3.3 identify and implement opportunities for error handling and reporting 3.4 make effective use of an Integrated Development Environment (IDE) including code and screen templates
LO4 Be able to test and document event driven programming solutions	4.1 critically review and test an event driven programming solution 4.2 analyse actual test results against expected results to identify discrepancies 4.3 evaluate independent feedback on a developed event driven programme solution and make recommendations for improvements 4.4 create onscreen help to assist the users of a computer program 4.5 create documentation for the support and maintenance of a computer program.

## Guidance

### Links to National Occupational Standards, other BTEC units, other BTEC qualifications and other relevant units and qualifications

The learning outcomes associated with this unit are closely linked with:

Level 3	Level 4	Level 5
Unit 6: Software Design and Development	Unit 18: Procedural Programming	Unit 35: Web Applications Development
Unit 14: Event Driven Programming	Unit 19: Object Oriented Programming	Unit 39: Computer Games Design Development
Unit 15: Object Oriented Programming	Unit 21 Software Applications Testing	Unit 40: Distributed Software Applications
Unit 16: Procedural Programming	Unit 22: Office Solutions Development	Unit 41: Programming in Java
	Unit 23: Mathematics for Software Development	Unit 42: Programming in .NET

This unit has links to the Level 4 and Level 5 National Occupational Standards for IT and Telecoms Professionals, particularly the areas of competence of:

- Software Development.

### Essential requirements

Whilst some event driven languages are commercially available, there are also free languages available incorporating an advanced set of event driven features deployed on many platforms. Centres must ensure that in the case of mobile platforms the applicable free emulators are available or where security policies dictate, local workstations are equipped with virtualised operating systems containing the programming environment.

Learners must have access to facilities, which allow them the opportunity to fully evidence all of the criteria of the unit. If this cannot be guaranteed then centres should not attempt to deliver this unit.

The learner must develop an application that is event driven and may work on a range of platforms, therefore it may be web based, GUI based, games console or a deliverable for a mobile platform amongst many other solutions.



## **Resources**

### **Books**

Balena F – *Programming Microsoft Visual Basic 2005: The Language* (Microsoft Press US, 2006) ISBN 0735621837

Bond M, Law D, Longshaw A, Haywood D and Roxburgh P – *Sams Teach Yourself J2EE in 21 Days, Second Edition* (Sams, 2004) ISBN 0672325586

Palmer G – *Java Event Handling* (Prentice Hall, 2001) ISBN 0130418021

Sharp J – *Visual J#.NET Core Reference* (Microsoft Press US, 2002) ISBN 0735615500

Suddeth J – *Programming with Visual Studio .NET 2005* (Lulu.com, 2006) ISBN 1411664477

Troelsen A – *Pro C# 2005 and the .NET 2.0 Platform, Third Edition* (Apress US, 2004) ISBN 1590594193

### **Websites**

<http://java.sun.com/docs/books/tutorial/>

<http://msdn.microsoft.com/en-us/visualc/default.aspx>

[http://tech.miradigm.com/proc\\_quick.php](http://tech.miradigm.com/proc_quick.php)

<http://visualbasic.freetutes.com/>

[www.developerfusion.com/tag/vb.net/](http://www.developerfusion.com/tag/vb.net/)

## **Employer engagement and vocational contexts**

Working with a local programming-based organisation or using internet-based open source projects would enhance the learners' experience and offer a relevant vocational context.

## Unit 21: Software Applications Testing

**Unit code:** L/601/1984

**QCF Level 4:** BTEC Higher National

**Credit value:** 15

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- **Aim**

To provide learners with an understanding of the principles of software applications testing as an essential element in the development of commercial applications for delivery to customers.

- **Unit abstract**

Linking into all programming units, this unit supports the detailed exploration, development and deployment of a functional commercial application. Taking the designed and implemented application and ensuring that it is tested and documented to a commercially viable standard.

Learners taking this unit will be able to work on a range of systems, being able to apply the testing techniques to procedural event driven and object oriented systems. There is no particular programming platform or preferred language inherent in the unit, it will support existing programming solutions as well as new developments.

A learner may work on GUI-based systems, a web-based application, a multimedia resource, a mobile (or handheld) application as well as a 'traditional' procedural programming environment to meet the outcomes of this unit. The assurance is that in any of the applications being tested the learner must be systematic and ensure the quality of the system being developed.

- **Learning outcomes**

**On successful completion of this unit a learner will:**

- 1 Understand the principles of software application testing
- 2 Be able to design test strategies
- 3 Be able to implement test plans
- 4 Be able to evaluate test plans.

## Unit content

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### 1 Understand the principles of software application testing

*Specification:* user needs eg analysis of requirements, expected outcomes, expected timeline

*Dry run of design:* testing eg given data, expected outcomes

*Implementation:* testing techniques eg black box, functional, white (or glass) box; sub-system testing eg integration, whole system, interface

*Methodology:* testing method eg top down, bottom up, component based, Graphical User Interface (GUI), code, event only, pre-alpha, alpha, beta

*Maintenance:* procedures eg following changes, reviews, time based, stress/overload

*User evaluation:* user testing eg against requirements, actual outcomes, acceptance, alpha participation, beta participation

*Requirements:* resources eg software, hardware, tester time, user time, system access

*Documentation:* technical documentation eg system and program specifications, user requirements, plans and logs

### 2 Be able to design test strategies

*Test strategy:* contents eg timing, justification, functionality, maintainability

*Test plan:* example data eg normal, erroneous, extreme; expected outcomes eg valid, invalid, information gained; prioritisation

*Techniques:* types of testing eg black box, functional, white (or glass) box, validation, verification, creation of test cases, reuse of test cases

*Versioning:* alpha testing in closed test; beta test in open environment; version cycles; bug fixing

### 3 Be able to implement test plans

*Reporting:* procedures eg manage reporting process, bug collection protocol, bug response and fix protocol

*Tools:* testing tools eg Bugzilla

*Fault identification:* procedures eg prioritisation, categorisation, response

*Monitoring:* procedures eg adjusting timelines, time management, allocation of resources, feedback to customer, managing adherence

### 4 Be able to evaluate test plans

*Evaluation:* of features eg functionality, accuracy, effectiveness, alterations to tests carried out, timeliness; of possible improvements eg program specification and design, self-reflection on product, aspects of test management; of maintainability eg usefulness to self, usefulness to others, usefulness for customers

## Learning outcomes and assessment criteria

Learning outcomes On successful completion of this unit a learner will:	Assessment criteria for pass The learner can:
LO1 Understand the principles of software application testing	1.1 evaluate testing techniques applicable to the testing opportunity 1.2 compare the relative benefits of different testing methodologies 1.3 justify a proposed testing methodology
LO2 Be able to design test strategies	2.1 design a test strategy for a given testing opportunity 2.2 design a test plan for a given testing opportunity 2.3 justify the test plan proposition and testing strategy
LO3 Be able to implement test plans	3.1 implement a test plan based on a given testing opportunity
LO4 Be able to evaluate test plans	4.1 critically review the test outcomes 4.2 justify the validity of the test and identify any potential issues.

## Guidance

### Links to National Occupational Standards, other BTEC units, other BTEC qualifications and other relevant units and qualifications

The learning outcomes associated with this unit are closely linked with:

Level 3	Level 4	Level 5
Unit 6: Software Design and Development	Unit 18: Procedural Programming	Unit 35: Web Applications Development
Unit 14: Event Driven Programming	Unit 19: Object Oriented Programming	Unit 39: Computer Games Design Development
Unit 15: Object Oriented Programming	Unit 20: Event Driven Programming Solutions	Unit 40: Distributed Software Applications
Unit 16: Procedural Programming	Unit 22: Office Solutions Development	Unit 41: Programming in Java
	Unit 23: Mathematics for Software Development	Unit 42: Programming in .NET

This unit has links to the Level 4 and Level 5 National Occupational Standards for IT and Telecoms Professionals, particularly the areas of competence of:

- Software Development
- IT/Technology Solution Testing.

### Essential requirements

Learners must have access to facilities, which allow them the opportunity to fully evidence all of the criteria of the unit. If this cannot be guaranteed then centres should not attempt to deliver this unit.

### Employer engagement and vocational contexts

Working with a local programming-based organisation or using internet-based open source projects would enhance the learners' experience and offer a relevant vocational context.

## Unit 22: Office Solutions Development

**Unit code:** R/601/1971

**QCF Level 4:** BTEC Higher National

**Credit value:** 15

- **Aim**

To equip learners with the knowledge and skills needed to develop application solutions that can be used to automate business processes.

- **Unit abstract**

Within an organisation, a range of business processes are functional at operational, tactical and strategic levels within the business structure. Some business processes are quite simplistic, especially at the operational level where routine, non-complex decisions and tasks are undertaken. However as you advance through the levels of an organisation, the strategic levels, more complex business processes and decision making is required that may need support from more automated, on-demand information systems and solutions.

Providing office solutions to support a range of business functions and decision making can range from the implementation of a simple rule or macro, through to the design of a more complex piece of code or program to support different end users.

This unit is designed to build upon existing skills and knowledge previously gained from using different types of application and design software. Learners will be expected to demonstrate more advanced skills in terms of data manipulation, configuration, application and implementation of software packages to enhance a given business processes or processes.

On completion of this unit the learner should be able to use design application software at an advanced level of proficiency. Learners will engage with a range of software, and select the most appropriate application(s) to offer feasible and working business solutions.

- **Learning outcomes**

**On successful completion of this unit a learner will:**

- 1 Understand how application software can support business processes
- 2 Be able to design and implement office solutions
- 3 Be able to demonstrate that business processes have been enhanced/improved.



## Unit content

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### 1 Understand how application software can support business processes

*Applications software:* types eg spreadsheets, database, presentation, graphics, desk-top publishing, word processing

*Business processes:* management eg supporting decision making, problem solving; operational eg sales, purchasing, marketing; support eg accounting, technical

*Supporting processes:* improving the efficiency of a business process eg forecasting, decision making, predictive reasoning; automating processes eg print runs, salary slips

*Supporting the user:* user requirements eg accessibility, usability, clarity, help

### 2 Be able to design and implement office solutions

*Solutions:* supporting a business process eg end user requirements, systems requirement, application to automate procedures, designing a tool, program or package that can perform a specific task to support problem-solving or decision-making at an advanced level, creating an e-Commerce function for a website to support a specific business process, designing a program for a specific end user that will support another application or process

*Design:* considerations eg addressing the user or system requirement; user-friendly and functional interface; consideration of user engagement and interaction with the designed solution; customization of the solution to satisfy the user and system requirements

*Advanced tools and techniques:* tools eg analysing data with interactive PivotTables and PivotCharts, linking Excel spreadsheets with Sharepoint, team collaboration and document management with Windows SharePoint; techniques eg creating decision-making macros, programming Access objects, building intuitive user interfaces with VBA, building ASP.net web applications

*Testing:* functionality: eg checking against requirements, error handling, documentation

### 3 Be able to demonstrate that business processes have been enhanced/improved

*User engagement:* engagement through eg meetings, questionnaires, interviews

*Enhanced/improved:* comparisons eg more efficient, faster results, more user friendly, improved compatibility with other systems and processes, improved management information

## Learning outcomes and assessment criteria

Learning outcomes  On successful completion of this unit a learner will:	Assessment criteria for pass  The learner can:
LO1 Understand how application software can support business processes	1.1 discuss ways in which applications software can support business processes 1.2 justify the use of different application software to support a given user requirement or business process 1.3 discuss the importance of addressing both user and business requirements
LO2 Be able to design and implement office solutions	2.1 design a solution to address a business or user need 2.2 use advanced tools and techniques to implement a solution 2.3 test a solution against expected results
LO3 Be able to demonstrate that business processes have been enhanced/improved	3.1 discuss ways in which end user engagement has taken place 3.2 provide evidence that business processes have been enhanced/improved 3.3 evaluate possible further improvements that could be made to enhance the system.

## Guidance

### Links to National Occupational Standards, other BTEC units, other BTEC qualifications and other relevant units and qualifications

The learning outcomes associated with this unit are closely linked with:

Level 3	Level 4	Level 5
Unit 6: Software Design and Development	Unit 18: Procedural Programming	Unit 35: Web Applications Development
Unit 14: Event Driven Programming	Unit 19: Object Oriented Programming	Unit 39: Computer Games Design Development
Unit 15: Object Oriented Programming	Unit 20: Event Driven Programming Solutions	Unit 40: Distributed Software Applications
Unit 16: Procedural Programming	Unit 21: Software Applications Testing	Unit 41: Programming in Java
	Unit 23: Mathematics for Software Development	Unit 42: Programming in .NET

This unit has links to the Level 4 and Level 5 National Occupational Standards for IT and Telecoms Professionals, particularly the areas of competence of:

- IT Application Management/Support.

### Essential requirements

Learners must have access to a range of applications and design software. In addition, examples of real-life business process scenarios would also provide further guidance and support in terms of their own solutions.

## Resources

### Books

Heathcote P – *Successful ICT Projects in Excel* (Payne Gallway, 2002) ISBN-10: 1903112710

Jellen B – *Brilliant Microsoft Excel 2007 VBA and Macros (Brilliant Excel Solutions)* (Prentice Hall, 2007) ISBN-10: 0273714058

Jellen B – *Excel VBA and Macros with MrExcel* (Video Training) (Livelessons) (QUE, 2009) ISBN-10: 0789739380

Rendell I, Mott J – *Advanced Spreadsheet Projects in Excel* (Hodder, 2008) ISBN 0340929243

### Websites

[http://spreadsheets.about.com/od/advancedexcel/Advanced\\_Topics\\_in\\_Excel\\_Spreadsheets.htm](http://spreadsheets.about.com/od/advancedexcel/Advanced_Topics_in_Excel_Spreadsheets.htm)

[www.ehow.com/topic\\_2573\\_advanced-excel-tutorial.html](http://www.ehow.com/topic_2573_advanced-excel-tutorial.html)

## Employer engagement and vocational contexts

To further enrich the content of this unit and to provide more of a vocational context it would be beneficial to bring in speakers from a range of organisations to discuss business processes and the applications that support these.



## Unit 23: Mathematics for Software Development

**Unit code:** D/601/0466

**QCF Level 4:** BTEC Higher National

**Credit value:** 15

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- **Aim**

To provide learners with an understanding of the underlying mathematical concepts that support the diverse fields supported by software engineers.

- **Unit abstract**

This unit is an introduction to some of the mathematical concepts and techniques that will be required by software engineers. To develop the mathematical skills necessary for software engineering learners must gain a range of mathematical skills, which are often applied in the creation of coded solutions to everyday problems.

The unit will allow the learner to appreciate and prepare for the more advanced concepts of mathematics required in relation to software engineering.

Learners taking this unit will explore areas of mathematics that are used to support programming. It will cover conditional statements, graphics and gaming (geometry and vectors), relationships in databases, the calling of methods (or procedures), matrices in the handling of arrays, large datasets and mapping, statistics, calculus and set theory.

- **Learning outcomes**

**On successful completion of this unit a learner will:**

- 1 Understand core mathematical skills for software engineers
- 2 Understand the application of algebraic concepts
- 3 Be able to apply the fundamentals of formal methods
- 4 Be able to apply statistical techniques to analyse data.



## Unit content

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### 1 Understand core mathematical skills for software engineers

*Algebra*: basic notation and rules of algebra; multiplication and factorisation of algebraic expressions involving brackets, algebraic equations and simultaneous linear equations, quadratic equations involving real roots

*Geometry*: types and properties of triangles, Pythagoras' Theorem, geometric properties of a circle; trigonometry: eg sine, cosine and tangent functions, angular measure

*Vectors*: representation of a vector by a straight line, equal and parallel vectors, magnitude of a vector, vector addition and subtraction, scalar multiplication, linear transformations, rotations, reflections, translations, inverse transformations, axioms of a vector space

### 2 Understand the application of algebraic concepts

*Relations*: domain, range, Cartesian product, universal relation, empty relation, inverse relation, reflexive, symmetric and transitive properties, equivalence relations

*Matrices*: addition and subtraction, scalar multiplication, matrix multiplication, properties of addition and multiplication of matrices, transpose of a matrix, determinant, identify matrix, inverse of a matrix, condition for a matrix to be singular, solution of simultaneous linear equations

*Application in programming*: use of variables and operators, using mathematics based commands, arrays, conditional statements, pseudo code, demonstration code

### 3 Be able to apply the fundamentals of formal methods

*Sets*: definitions of set and element, representation of sets using Venn diagrams, universal and empty sets, finite and infinite sets,  $\mathbb{N}$ ,  $\mathbb{Z}$  and  $\mathbb{R}$ , operations on sets, subsets, notation, predicates; laws of set theory; idempotent, associative, commutative, distributive, identity, involution, complement, De Morgan's laws

*Propositional calculus*: simple and compound propositions, conjunction, disjunction, negation, implication and bi-implication, truth tables, validity, principle of mathematical induction, logical argument and deductive proof

*Boolean laws of propositional calculus*: idempotent, associative, commutative, distributive, identity, involution, complement, De Morgan's Laws

### 4 Be able to apply statistical techniques to analyse data

*Techniques*: frequency distribution, mean, median, variance, deviation, correlation probability, factorial notation, permutations and combinations, laws of probability, conditional probability, Bayesian Networks

## Learning outcomes and assessment criteria

Learning outcomes  On successful completion of this unit a learner will:	Assessment criteria for pass  The learner can:
LO1 Understand core mathematical skills for software engineers	1.1 design a programming solution to a given algebraic problem 1.2 design a programming solution to a given geometric problem 1.3 implement code that presents a range of vectors
LO2 Understand the application of algebraic concepts	2.1 explain how relations link to technologies used in programming 2.2 design a programming solution to solve a given matrix manipulation
LO3 Be able to apply the fundamentals of formal methods	3.1 discuss the application of set theory in computing 3.2 design a programming solution to a given propositional calculus problem
LO4 Be able to apply statistical techniques to analyse data	4.1 design a programming solution to solve a given statistical analysis technique.

## Guidance

### Links to National Occupational Standards, other BTEC units, other BTEC qualifications and other relevant units and qualifications

The learning outcomes associated with this unit are closely linked with:

Level 3	Level 4	Level 5
Unit 6: Software Design and Development	Unit 18: Procedural Programming	Unit 35: Web Applications Development
Unit 14: Event Driven Programming	Unit 19: Object Oriented Programming	Unit 39: Computer Games Design Development
Unit 15: Object Oriented Programming	Unit 20: Event Driven Programming Solutions	Unit 40: Distributed Software Applications
Unit 16: Procedural Programming	Unit 21: Software Applications Testing	Unit 41: Programming in Java
Unit 26: Mathematics for IT Practitioners	Unit 22: Office Solutions Development	Unit 42: Programming in .NET

This unit has links to the Level 4 and Level 5 National Occupational Standards for IT and Telecoms Professionals, particularly the areas of competence of:

- Software Development.

### Essential requirements

The programming environment(s) selected must be based on systems already used by the learners so that they are familiar with the systems and commands used.

Learners must have access to facilities, which allow them the opportunity to fully evidence all of the criteria of the unit. If this cannot be guaranteed then centres should not attempt to deliver this unit.

It is important that learners understand the mathematical concept as well as its relationship to software development.

The centre delivering the unit must present suitable geometric, algebraic, matrix, calculus and statistics problems. Problems must support the learning outcomes. Some of these problems may be used as assessment in other programming units, where the problem presented to learners explores a more complex scenario, drawing on the relevant skills.

Evidence for learning outcomes must be achieved through well-planned coursework, assignments and projects.

## Resources

### Books

Press W et al – *Numerical Recipes 3rd Edition: The Art of Scientific Computing* (Cambridge University Press, 2007) ISBN-10: 0521880688

Press W et al – *Numerical Recipes Source Code CD-ROM 3rd Edition: The Art of Scientific Computing* (Cambridge University Press, 2007) ISBN-10: 0521706858

Golub G, Van Loan C – *Matrix Computations (Johns Hopkins Studies in the Mathematical Sciences)* (John Hopkins University Press, 1996) ISBN-10: 0801854148

Haggarty R – *Discrete Mathematics for Computing* (Addison Wesley, 2001) ISBN-10: 0201730472

Schwartz JT et al – *Set Theory for Computing: From Decision Procedures to Declarative Programming with Sets (Monographs in Computer Science)* (Springer 2001) ISBN-10: 0387951970

Rothenberg R – *Basic Computing for Calculus* (McGraw Hill, 1985) ISBN-10: 007054011X

### Websites

[www.mathsandcomputing.com/](http://www.mathsandcomputing.com/)

## Employer engagement and vocational contexts

In supporting the outcomes from other units, this unit can be used to support the creation of a software application in a vocational context where part of the application may use one (or more) of the mathematical outputs from this unit.



## Unit 24: Networking Technologies

**Unit code:** M/601/0472

**QCF Level 4:** BTEC Higher National

**Credit value:** 15

- **Aim**

To enable learners to understand computer networking concepts, how they work, how they operate and the protocols, standards and the models associated with networking technology.

- **Unit abstract**

Understanding of the underlying principles of networking is of vital importance to all IT professionals in an environment that is increasingly complex and under continuous development.

The aim of this unit is to provide a background to the basic components of networked systems from which all networking operations derive. It also includes the evaluation of networks and network applications.

Learners taking this unit will explore a range of hardware and technologies, culminating in the design and deployment of a networked system. Working with many technologies, this unit can be used for mobile systems, local area networks as well as larger scale wider area networked systems. Supporting a range of units in the Higher National suite this unit underpins the principles of networks for all and enables learners to work towards their studies in vendor units if applicable.

- **Learning outcomes**

**On successful completion of this unit a learner will:**

- 1 Understand networking principles
- 2 Understand networking components
- 3 Be able to design networked systems
- 4 Be able to implement and support networked systems.



## Unit content

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### 1 Understand networking principles

*Role of networks:* purpose, benefits, resource implications, communications, working practice, commercial opportunity, information sharing, collaboration

*System:* types, eg peer based, client-server, cloud, cluster, centralised, virtualised

*Networking standards:* conceptual models eg OSI model, TCP/IP model; standards: eg IEEE 802.x

*Topology:* logical eg Ethernet, Token Ring; physical eg star, ring, bus, mesh, tree, ring

*Communication:* bandwidth, throughput

*Protocols:* relationship to networking standards; purpose of protocols; routed protocols eg IPv4, IPv6, FTP, HTTP, SMTP, POP3, SSL; management of protocols for addressing; routing protocols eg RIP, RIPv2, OSPF, OSPFv3, BGP

### 2 Understand networking components

*Hardware components:* workstation eg mobile, fixed, handheld, console; servers; switches; routers; cabling; hubs; repeaters; bridges; wireless devices; mobile eg 3G, 4G, GPRS

*Software components:* software eg client software, server software, client operating system, server operating system

*Server:* type eg firewall, email, web, file, database, combination, virtualisation, terminal services server

*Server selection:* cost, purpose, operating system requirement

*Workstation:* hardware eg network card, cabling; permissions; system bus; local-system architecture eg memory, processor, I/O devices

### 3 Be able to design networked systems

*Bandwidth:* expected average load; anticipated peak load; local internet availability; cost constraints

*Users:* quality expectations, concept of system growth

*Applications:* security requirements, quality of service needs

*Communications:* suited to devices, suited to users, supportive of lifestyle desires, supportive of commercial requirements

*Scalable:* able to support device growth, able to support addition of communication devices, able to cope with bandwidth use and trend changes, protocol utilisation, addressing

*Selection of components:* supporting infrastructure needs; supporting connectivity requirements

#### 4 **Be able to implement and support networked systems**

*Devices:* installation of communication devices, allocation of addresses, local client configuration, server configuration, server installation

*Connectivity:* installation of internet work communication medium

*Testing:* communication; bandwidth

*User access:* bandwidth, applications, devices

*Policy review:* bandwidth, resource availability

*System monitoring:* utilisation, bandwidth needs, monitoring user productivity

*Maintenance schedule:* backups, upgrades, security, auditing

## Learning outcomes and assessment criteria

Learning outcomes  On successful completion of this unit a learner will:	Assessment criteria for pass  The learner can:
LO1 Understand networking principles	1.1 discuss the benefits and constraints of different networking systems types and topologies 1.2 evaluate the impact of current network technology, communication and standards 1.3 discuss how protocols enable the effective utilisation of different networking systems
LO2 Understand networking components	2.1 discuss the role of software and hardware components 2.2 discuss server types and selection requirement 2.3 discuss the inter-dependence of workstation hardware with network components
LO3 Be able to design networked systems	3.1 design a networked system to meet a given specification 3.2 evaluate the design and analyse user feedback
LO4 Be able to implement and support networked systems	4.1 implement a networked system based on a prepared design 4.2 test the network system to meet user requirements 4.3 document and analyse test results against expected results 4.4 recommend potential enhancements for the networked systems 4.5 design a maintenance schedule to support the networked system.

## Guidance

### Links to National Occupational Standards, other BTEC units, other BTEC qualifications and other relevant units and qualifications

The learning outcomes associated with this unit are closely linked with:

Level 3	Level 4	Level 5
Unit 5: Managing Networks	Unit 2: Computer Systems	Unit 36: Internet Server Management
Unit 9: Computer Networks	Unit 25: Routing Concepts	Unit 43: Networking Infrastructure
Unit 10: Communication Technologies	Unit 26: Design a Small or Home Office Network	Unit 44: Local Area Networking Technologies
Unit 32: Networked Systems Security	Unit 27: Network Operating Systems	Unit 45: Wide Area Networking Technologies
	Unit 28: IT Support for End Users	Unit 46: Network Security

This unit has links to the Level 4 and Level 5 National Occupational Standards for IT and Telecoms Professionals, particularly the areas of competence of:

- IT/Technology Infrastructure Design and Planning
- Systems Development
- IT/Technology Service Operations and Event Management
- IT/Technology Management and Support.

### Essential requirements

Learners must have access to a live or 'detached' network environment to create the network infrastructure and develop their skills; this may be successfully accomplished using virtual machines.

Evaluation of current systems and solutions, commercial practices, social conditions and the culture surrounding the system in use is of as much importance as delivering work supporting potential understanding of the technological systems and the services they offer.

Implementation of the networked system must be tested systematically and based on the technology used in the design solution. The final system implemented may be on a live system, but ideally should be tested in a simulated or sand box environment.

## Resources

### Books

Burgess M – *Principles of Network and System Administration, 2nd Edition* (John Wiley and Sons Ltd, 2003) ISBN 0470868074

Hallberg B – *Networking: A Beginner's Guide, 4th Edition* (Osborne/McGraw-Hill US, 2005) ISBN 0072262125

Limoncelli T and Hogan C – *The Practice of System and Network Administration* (Addison Wesley, 2001) ISBN 0201702711

Lowe D – *Networking All-in-One Desk Reference for Dummies, 2nd Edition* (Hungry Minds Inc US, 2005) ISBN 0764599399

More M, Southwick P, Pritsky T and Riggs C – *Telecommunications: A Beginner's Guide* (McGraw-Hill Education, 2001) ISBN 0072193565

Olifer N and Olifer V – *Computer Networks: Principles, Technologies and Protocols for Network Design* (John Wiley and Sons Ltd, 2005) ISBN 0470869828

Schiller J – *Mobile Communications, 2nd Edition* (Addison Wesley, 2003) ISBN 0321123816

Subramanian M – *Network Management: An Introduction to Principles and Practice* (Addison Wesley, 2000) ISBN 0201357429

### Websites

[www.cisco.com](http://www.cisco.com)

[www.howstuffworks.com](http://www.howstuffworks.com)

[www.webopedia.com](http://www.webopedia.com)

[www.wikipedia.org](http://www.wikipedia.org)

## Employer engagement and vocational contexts

Working with a live system will present many risks, that the centre, employer and learner must be aware of using a current vocational context to deploy an additional or alternate solution will enhance the learners experience and enable understanding of wider technical application.

## Unit 25: Routing Concepts

**Unit code:** Y/601/1423

**QCF Level 4:** BTEC Higher National

**Credit value:** 15

- **Aim**

To provide learners with an understanding of the complexities of routing and routed networks, which includes the management of reliable communication across a distributed LAN or WAN infrastructure.

- **Unit abstract**

Networks such as the internet have become a part of everyday life with many commercial, educational and governmental organisations having ownership or access to a routed network infrastructure. Where any system has to endure segmentation, for security, traffic management or distance communication, a routed infrastructure ensures the persistence of communication and the management of data transfer.

The impact of a routed network across an organisation requires the up-skilling of staff, changes to the physical environment and changes to commercial procedures. For example connectivity between departments may take a new routed pathway, and access, security and ownership of data may change as a result of the addition of routed subnets to the network. Learners will understand that consideration must be given to not only the physical network but the organisational culture as well.

Learners will also understand how routing affects network communication and how routers utilise protocols to 'learn' about the changing topology in a network infrastructure in order to offer reliable data transfer.

- **Learning outcomes**

**On successful completion of this unit a learner will:**

- 1 Understand the impact of routing technologies
- 2 Be able to design complex routed environments
- 3 Be able to implement complex routed environments
- 4 Be able to troubleshoot and monitor routed environments.



## Unit content

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### 1 Understand the impact of routing technologies

*Routing hardware:* hardware eg access routers, distribution routers, core switches, layer 3 switches

*Routing protocols:* protocol eg interior routing protocols, exterior routing, static routing

*Protocol management:* management eg redistribution between protocols, route maps, route filters

*Device management:* management eg password control, access levels, configuration storage, remote access

*Network management:* types eg address allocation, interface configuration, load balancing, mirroring, costing routes, changing metrics, hop-count

*Security:* requirements eg MD5 hash (Message Digest), update control, access control lists, directed updates, tunnelling

### 2 Be able to design complex routed environments

*Devices:* types eg expected average number of routing devices on system

*Bandwidth:* types eg expected average load; anticipated peak load; cost constraint

*Users:* types eg quality expectations, concept of system growth

*Applications:* types eg allowing, denying ingress/egress

*Communications:* types eg suited to devices, suited to users, suited to environment

*Scalable:* types eg able to support network growth, able to support addition of communication devices, able to cope with bandwidth use and trend change

*Security:* network access, protocol management

*Technology:* network design, routing table reduction, protocol management, convergence time, protocol specific, number of hops, routing table size

### 3 Be able to implement complex routed environments

*Devices:* types eg access routers, distribution routers, core switches, layer 3 switches; installation of routing devices; allocation of networks; routing device configuration

*Specialised configuration:* eg routing protocol, redistribution, interfaces, network address allocation, security features

*Security:* types eg ACL's (Access Control Lists), MD5 authentication, routing device

*Connectivity:* types eg suitable bandwidth, communication infrastructure, throughput

*Testing:* systems eg local communication, end-to-end communication; security; bandwidth; routing table validity

**4 Be able to troubleshoot and monitor routed environments**

*Infrastructure performance:* network monitoring tools, user access, traffic analysis, bandwidth monitoring, checking configuration, checking rules, show commands, traceroute

*Resolve issues:* use troubleshooting methodology; make change to resolve issue; prove resolution

## Learning outcomes and assessment criteria

Learning outcomes  On successful completion of this unit a learner will:	Assessment criteria for pass  The learner can:
LO1 Understand the impact of routing technologies	1.1 evaluate current routing hardware and routing protocols 1.2 evaluate device and network management 1.3 evaluate current security requirements
LO2 Be able to design complex routed environments	2.1 design a routed environment to meet a given specification. 2.2 evaluate design and analyse user feedback
LO3 Be able to implement complex routed environments	3.1 implement a routed environment from a design specification 3.2 test the routed environment 3.3 document and analyse test results
LO4 Be able to troubleshoot and monitor routed environments	4.1 monitor and evaluate infrastructure performance against a given specification 4.2 resolve issues to improve performance.

## Guidance

### Links to National Occupational Standards, other BTEC units, other BTEC qualifications and other relevant units and qualifications

The learning outcomes associated with this unit are closely linked with:

Level 3	Level 4	Level 5
Unit 5: Managing Networks	Unit 2: Computer Systems	Unit 36: Internet Server Management
Unit 9: Computer Networks	Unit 24: Networking Technologies	Unit 43: Networking Infrastructure
Unit 10: Communication Technologies	Unit 26: Design a Small or Home Office Network	Unit 44: Local Area Networking Technologies
Unit 32: Networked Systems Security	Unit 27: Network Operating Systems	Unit 45: Wide Area Networking Technologies
	Unit 28: IT Support for End Users	Unit 46: Network Security

This unit has links to the Level 4 and Level 5 National Occupational Standards for IT and Telecoms Professionals, particularly the areas of competence of:

- IT/Technology Infrastructure Design and Planning
- Systems Development
- IT/ Technology Service Operations and Event Management
- IT/Technology Management and Support
- Change and Release Management.

### Essential requirements

Learners must have access to a live or 'detached' network environment to create the network infrastructure and develop their skills; this may be successfully accomplished using virtual machines.

Learners must have access to facilities, which allow them the opportunity to fully evidence all the criteria of the unit. If this cannot be guaranteed then centres should not attempt to deliver this unit.

Evaluation of current systems and solutions, commercial practices, social conditions and the culture surrounding the system in use is of as much importance as delivering work supporting potential understanding of the technological systems and the services they offer.

Learners must have access to a range of suitable routing hardware as it is important to undertake as many practical activities as possible to reinforce theoretical learning. There are many virtual, emulated and simulated systems that now support delivery.

**Resources****Books**

Macfarlane J – *Network Routing Basics: Understanding IP Routing in Cisco Systems* (Wiley, 2006)  
ISBN-10: 0471772739

Medhi D, Ramasamy K – *Network Routing: Algorithms, Protocols, and Architectures* (Morgan Kaufmann, 2007) ISBN-10: 0120885883

Xiao Y, Li J, Pan Y – *Security and Routing in Wireless Networks: Wireless Networks and Mobile Computing v. 3* (Nova Science, 2005) ISBN-10: 159454316X

**Websites**

[www.aplawrence.com/Girish/gentle-routing.html](http://www.aplawrence.com/Girish/gentle-routing.html)

[www.cisco.com](http://www.cisco.com)

[www.sangoma.com/support/tutorials/tcp\\_ip.html](http://www.sangoma.com/support/tutorials/tcp_ip.html)

**Employer engagement and vocational contexts**

Working with a live system will present many risks, that the centre, employer and learner must be aware of. Using a current vocational context to deploy an additional or alternate solution will enhance the learners experience and enable understanding of wider technical application.

## Unit 26: Design a Small or Home Office Network

**Unit code:** Y/601/0448

**QCF Level 4:** BTEC Higher National

**Credit value:** 15

### ● Aim

To provide learners with opportunities to design, implement, manage and support a small or home office network as a standalone system or as part of a larger remote infrastructure.

### ● Unit abstract

IT utilisation has evolved rapidly since the initial personal internet boom of the late 1990s with the majority of private homes and small organisations now having megabit capable bandwidth and an extensive range of devices able to connect to the Internet.

For many home and commercial users of the internet, the design of a system could be an ad hoc affair, with many high-street retailers offering 'out-of-the-box' solutions. Whilst this solution will suit the lower capacity user, many discover the limitations of security, scale and device interaction offered.

Learners taking this unit will explore how private homes and small organisations, as well as branches of larger enterprises can create a system that will scale according to demand. Learners will also have the opportunity to consider how they may design and deploy a system with the potential to adapt to technological change as well as user preference.

There is no restriction on the type of system or devices that may be incorporated into the learning behind this unit. The technological aspect ranges from games consoles through to mobile devices as well as systems with only two or three users up to a system that may have to support at least 50 users or devices.

### ● Learning outcomes

**On successful completion of this unit a learner will:**

- 1 Understand the impact of small or home office networks
- 2 Be able to design small or home office networks
- 3 Be able to implement small or home office networks
- 4 Be able to support small or home office networks.



## Unit content

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### 1 Understand the impact of small or home office networks

*Mobility:* device participation, range of devices on system

*Capacity:* constraints eg bandwidth to internet; local internet contention ratio; internal network bandwidth; internal network contention ratio; bandwidth requirements (applications; users; devices)

*Devices:* types eg phones, handheld consoles, Personal Digital Assistants (PDA), laptops, games consoles, workstations, printers, network drives, media centres

*Usage:* activities eg entertainment, gaming, social networking, video streaming; users eg commercial, personal, home working

*Security:* methods eg address allocation, local Demilitarized Zone (DMZ), Network Address Translation (NAT) address mapping, wireless encryption, Virtual Private Network (VPN) to central employer/commercial location, device security, firewall

*Communications:* connections eg wireless, wired, Ethernet over power, 3G, Bluetooth, broadband, Asymmetric Digital Subscriber Line (ADSL)

*Impacts:* social practice eg working patterns, social engagement, user expectations, entertainment, sharing of resource, use of technology

### 2 Be able to design small or home office networks

*Devices:* number of connected devices; anticipated participation

*Bandwidth:* average load; peak load; local Internet availability; cost constraint

*Users:* quality expectations; concept of system growth

*Applications:* requirements eg security, quality of service

*Communications:* considerations eg suited to devices, suited to users, lifestyle preferences, commercial requirements

*Scalable:* considerations eg supporting device growth, supporting additional devices, bandwidth use trend change

*Security:* considerations eg addressing policy, device participation, firewall rules, encryption preference

### 3 Be able to implement small or home office networks

*Devices:* installation eg communication device, allocation of addresses, local client configuration

*Connectivity:* setup eg communication medium, external network, internet connection

*Testing:* internet access; security; bandwidth; documentation eg comparison charts, performance graphs

#### 4 **Be able to support small or home office networks**

*User access:* requirements eg applications, devices, bandwidth

*Maintenance:* monitoring eg security, utilisation, bandwidth needs, user productivity

*Future improvements:* upgrades eg adding devices, removing devices, upgrade bandwidth, additional communications devices; maintenance schedule eg backups, upgrades, security, auditing

## Learning outcomes and assessment criteria

Learning outcomes On successful completion of this unit a learner will:	Assessment criteria for pass The learner can:
LO1 Understand the impact of small or home office networks	1.1 evaluate the usage and impact of current small or home office networks
LO2 Be able to design small or home office networks	2.1 design a small or home office network solution to meet a given specification 2.2 evaluate the design and analyse user feedback
LO3 Be able to implement small or home office networks	3.1 implement a small or home office network solution based on a prepared design 3.2 test the small or home office network solution to meet user requirements 3.3 document and analyse test results against expected results
LO4 Be able to support small or home office networks	4.1 discuss future improvements for the small or home office network 4.2 design a maintenance schedule to support a small or home office network.

## Guidance

### Links to National Occupational Standards, other BTEC units, other BTEC qualifications and other relevant units and qualifications

The learning outcomes associated with this unit are closely linked with:

Level 3	Level 4	Level 5
Unit 5: Managing Networks	Unit 2: Computer Systems	Unit 36: Internet Server Management
Unit 9: Computer Networks	Unit 24: Networking Technologies	Unit 43: Networking Infrastructure
Unit 10: Communication Technologies	Unit 25: Routing Concepts	Unit 44: Local Area Networking Technologies
Unit 32: Networked Systems Security	Unit 27: Network Operating Systems	Unit 45: Wide Area Networking Technologies
	Unit 28: IT Support for End Users	Unit 46: Network Security

This unit has links to the Level 4 and Level 5 National Occupational Standards for IT and Telecoms Professionals, particularly the areas of competence of:

- IT/Technology Infrastructure Design and Planning
- Systems Development

### Essential requirements

Learners must have access to a live or 'detached' network environment to create the network infrastructure and develop their skills, this may be successfully accomplished using virtual machines.

Learners must have access to facilities which allow them the opportunity to fully evidence all of the criteria of the unit. If this cannot be guaranteed then centres should not attempt to deliver this unit.

Evaluation of current systems and solutions, commercial practices, social conditions and the culture surrounding the system in use is of as much importance as delivering work supporting potential understanding of the technological systems and the services they offer.

If your centre is using a real network to base the design upon, you must consider the legal implications of how this may affect the owners of the real network, as well as for the learner and the academic centre.

Implementation of the SOHO solution must be tested systematically and procedurally based on the technology used in the design solution.

## Resources

### Books

Moulton P – *Soho Networking: A Guide to Installing a Small Office/Home Network* (Prentice Hall, 2002) ISBN-10: 0130473316

Reed A, Lorenz J – *Networking for Home and Small Businesses, CCNA Discovery Learning Guide* (Cisco Press, 2007) ISBN-10: 1587132095

### Employer engagement and vocational contexts

Working with a live system will present many risks that the centre, employer and learner must be aware of. Using a current vocational context to deploy an additional or alternate solution will enhance the learner's experience and enable understanding of wider technical application.

## Unit 27: Network Operating Systems

**Unit code:** K/601/0468

**QCF Level 4:** BTEC Higher National

**Credit value:** 15

- **Aim**

To provide learners with the knowledge, skills and techniques necessary to install, configure, troubleshoot and maintain a reliable network operating systems service.

- **Unit abstract**

Modern enterprise organisations rely on the use of a range of network operating systems (NOS), to establish the networking services necessary to run their IT infrastructure. Supporting a NOS is considered one of the primary roles of a professional network administrator. It is part of their duties to identify the NOS as required, undertake the installation and deployment of network servers, and configure, support and maintain the NOS. This may also involve routine administration, the management of systems and user security policies as well as more specific specialist tasks.

This unit will allow learners to install, configure, support and maintain complex NOS and servers. They will learn the skills and knowledge to use the NOS, to provide enterprise users access to the services and resources, in a secure environment, making sure that business data is protected against internal and external attacks or disasters.

- **Learning outcomes**

**On successful completion of this unit a learner will:**

- 1 Understand network operating systems principles
- 2 Be able to plan the implementation of network operating systems
- 3 Be able to implement network operating systems
- 4 Be able to manage network operating systems.



## Unit content

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### 1 Understand network operating systems principles

*NOS*: types eg standalone, infrastructure based, cluster based

*NOS services*: types eg file, web, print, remote access, proxy, terminal services, firewall, access control, infrastructure management, ecommerce

*Disaster recovery*: backup methodology, data recovery, mirrored systems, virtualisation, UPS (Uninterruptible Power Supply), backup-power supply, off site management, high availability, fault tolerance

*NOS selection*: open source, proprietary, general purpose, task specific

*NOS security*: management of updates/patches, anti-virus protection, physical access policies, service access policies, user access policies, policy management, user audits, group audits, continual vetting of access, authentication policies and practice, password policy

### 2 Be able to plan the implementation of network operating systems

*Naming system*: method eg registration of server on directory service, infrastructure requirement, issue of local name for server

*Addressing*: method eg allocation of addresses for NOS services

*Installation*: preparation eg selection of hardware, memory requirement, standalone, infrastructure, virtual server, storage requirement, disk partitioning, RAID allocation

*Service*: selection eg file, web, print, remote access, proxy, terminal services, firewall, access control, infrastructure management, ecommerce

*Security*: policy eg patch management, anti-viral management, access requirement, administrative rights, authentication, password policy

*Disaster recovery*: policy eg backup methodology, mirrored services, virtualisation, UPS, backup-power supply, off site management, high availability, fault tolerance

### 3 Be able to implement network operating systems

*NOS*: installation: eg selection of media, application of NOS to selected installation environment, application of naming system, application of addressing

*Service*: installation: eg file, web, print, remote access, proxy, terminal services, firewall, access control, infrastructure management, ecommerce

*Security*: configuration eg installation of updates, installation of anti-viral management, setting of administrative rights, setting of authentication policy, setting of password policy

*Disaster recovery*: configuration eg mirrored services, virtualisation, UPS, backup-power supply, off site management, high availability, fault tolerance services

*Testing*: eg access to network, other devices able to access services

#### 4 **Be able to manage network operating systems**

*Performance:* baseline eg establishing normal performance without load, establishing performance with load

*Monitor:* performance eg setting up and monitoring event logs, optimising server performance, using performance tools

*Updating NOS:* eg implementing a security policy and auditing system, applying patches, security updates, reviewing user access, adding new services

## Learning outcomes and assessment criteria

Learning outcomes On successful completion of this unit a learner will:	Assessment criteria for pass The learner can:
LO1 Understand network operating systems principles	1.1 evaluate types of NOS and NOS services 1.2 discuss the benefit of disaster recovery and NOS security 1.3 critically compare a selection of current NOS's in use
LO2 Be able to plan the implementation of network operating systems	2.1 plan the implementation of a NOS for a required service to meet a given specification 2.2 evaluate the plan and analyse user feedback
LO3 Be able to implement network operating systems	3.1 implement a NOS service based on a prepared plan 3.2 test the NOS to meet user requirements 3.3 document and analyse test results against expected results
LO4 Be able to manage network operating systems	4.1 establish and justify a performance baseline 4.2 monitor NOS performance against the baseline 4.3 justify performance optimisation and update to NOS.

## Guidance

### Links to National Occupational Standards, other BTEC units, other BTEC qualifications and other relevant units and qualifications

The learning outcomes associated with this unit are closely linked with:

Level 3	Level 4	Level 5
Unit 5: Managing Networks	Unit 2: Computer Systems	Unit 36: Internet Server Management
Unit 9: Computer Networks	Unit 24: Networking Technologies	Unit 43: Networking Infrastructure
Unit 10: Communication Technologies	Unit 25: Routing Concepts	Unit 44: Local Area Networking Technologies
Unit 32: Networked Systems Security	Unit 26: Design a Small or Home Office Network	Unit 45: Wide Area Networking Technologies
	Unit 28: IT Support for End Users	Unit 46: Network Security

This unit has links to the Level 4 and Level 5 National Occupational Standards for IT and Telecoms Professionals, particularly the areas of competence of:

- IT/Technology Infrastructure Design and Planning
- Systems Development
- IT Application Management/Support
- IT/Technology Management and Support.

### Essential requirements

Learners must have access to a live or 'detached' network environment to create the network infrastructure and develop their skills; this may also be successfully accomplished using virtual machines.

This is a technical unit, which requires that learners are provided with an appropriate networking environment to allow them to practice all the skills and techniques outlined in the criteria, and to produce the required evidence to prove their competence.

Learners need to be provided with the opportunity to build a computer systems network of at least one client and one server, so they will be in position to install the NOS and configure it for client's access. Learners must also install the networking services and configure them as required. This may be in a contained environment and could be via a training LAN or may be on one system using multiple virtual machine images.

## **Resources**

### **Books**

Barrett D – *Linux Pocket Guide (Pocket Guide: Essential Commands)* (O'Reilly Media, 2004)  
ISBN-10: 0596006284

Cisco Inc – *Cisco Networking Academy Program: IT Essentials II - Network Operating System Engineering Journal and Workbook* (Cisco Press, 2003) ISBN-10: 1587130955

Corp – *Microsoft Windows 2000 Network and Operating System Essentials* (iUniverse, 2001)  
ISBN-10: 059514814X

Watson R – *Introduction to Operating Systems and Networks* (Prentice Hall, 2003)  
ISBN-10: 0131118943

### **Websites**

[www.cisco.com](http://www.cisco.com)

[www.howstuffworks.com/operating-system.htm/printable](http://www.howstuffworks.com/operating-system.htm/printable)

[www.microsoft.com](http://www.microsoft.com)

## **Employer engagement and vocational contexts**

Working with a live system will present many risks, that the centre, employer and learner must be aware of. In using a current vocational context to deploy an additional or alternate solution will enhance the learners' experience and enable understanding of wider technical application.

## Unit 28: IT Support for End Users

**Unit code:** F/601/0458

**QCF Level 4:** BTEC Higher National

**Credit value:** 15

- **Aim**

To enable learners to perform user support tasks and to provide training materials for users and user support staff.

- **Unit abstract**

As the number and variety of systems used by management, administration and other non-IT professionals grows, and as organisations become increasingly dependent upon these, the need to provide efficient, effective and consistent support to the users of these systems becomes paramount.

Computer users need appropriate training and support in order to be able to make best use of the systems available to them. As problems will inevitably occur, they also need access to knowledgeable and sympathetic staff within a formal framework of support. This is often via a help desk which, depending on the complexity of the problem, may provide direct assistance, remote support or refer to further expert support.

Learners will begin this unit by looking at how to analyse a reported problem and provide user support. This can be in the context of the problem and also in preventive training. Learners will evaluate how problems affect user productivity.

Learners will then deliver appropriate user support, both by remote means and in person. They will design and apply methods of monitoring and documenting user support activities.

Finally, learners explore user support planning including production of user manuals, training courses, and plans for system maintenance and disaster recovery.

- **Learning outcomes**

**On successful completion of this unit a learner will:**

- 1 Understand user problems
- 2 Be able to provide user support
- 3 Be able to create user support programmes.



## Unit content

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### 1 Understand user problems

*Analysis of problem:* incoming incidents; problems; change requests; identifying user requirements eg accessing user computer systems (remotely or at the desktop), user description; using software tools; human factors eg appreciation of user frustration, appropriate communication techniques

*Types of problem:* technical problems eg hardware (compatibility, failure, degradation, configuration), software (compatibility, failure, corruption, configuration), system capacity problems, transmission problems (cables, switches, routers), connectivity problems (internet, other systems, printers, shared resources); continuous; user created; system changes (automatic updates, installed patches)

*Response:* support levels, methods of supporting a user eg immediate response, advice on access to manuals, help systems, obtaining additional support

*Evaluation:* estimations of system downtime and reduction in user productivity

### 2 Be able to provide user support

*Incident recording:* details eg customer name, problem, date and time of call, response, action taken, time taken to resolve problem; media to store details eg paper, software; support materials consulted eg manuals, guides, multimedia, courses

*Fault diagnosis:* tools eg remote fault diagnosis, third-party utilities; record tests carried out, advise on corrective action, confirm problem has been solved

*User support:* remote; in person; incidents eg software update, device driver installation, re-configuring network card, adding memory chips; change of motherboard; installing new hard drive

### 3 Be able to create user support programmes

*User support manual:* troubleshooting eg logging on, accessing the network, email, browser issues, printer problems, viruses, mobile access; accessing software eg office, company bespoke.

*User training:* identifying training needs; IT policy (email, web, software installation); security; applications; routine maintenance.

*Support planning:* upgrading/replacement of existing system hardware/software, infrastructure (backbone, routers, switches, cabling, WAPs).

*System maintenance:* preventative, predictive, remedial; routine maintenance eg backing up, cleaning, virus scan, defragmentation, removal of temporary files, password policies.

*Recovery plans:* hardware failure (workstation, server), natural disaster, power failure, major loss of data, security breaches, restoring data.

## Learning outcomes and assessment criteria

Learning outcomes  On successful completion of this unit a learner will:	Assessment criteria for pass  The learner can:
LO1 Understand user problems	1.1 discuss an analytical approach to solving different types of user problems 1.2 evaluate the impact of problems on user productivity
LO2 Be able to provide user support	2.1 design suitable methods to monitor and document technical support activities 2.2 deliver user support, both at the desktop and remotely, to meet user needs
LO3 Be able to create user support programmes	3.1 design a user support manual for an organisation that could be used by users before contacting the help desk 3.2 devise a training course that could be presented to new employees of a company to enable them to be familiar with company IT policies and systems 3.3 produce a system support services plan for an organisation that includes support planning, system maintenance and disaster recovery.

## Guidance

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### Links to National Occupational Standards, other BTEC units, other BTEC qualifications and other relevant units and qualifications

The learning outcomes associated with this unit are closely linked with:

Level 3	Level 4	Level 5
Unit 12: IT Technical Support	Unit 2: Computer Systems	
Unit 13: IT Systems Troubleshooting and Repair	Unit 24: Networking Technologies	
Unit 29: Installing and Upgrading Software		

This unit has links to the Level 4 and Level 5 National Occupational Standards for IT and Telecoms Professionals, particularly the areas of competence of:

- IT/Technology Service Helpdesk and Incident Management
- IT Application Management/Support
- IT/Technology Management and Support.

### Essential requirements

Learners must be given access to appropriate hardware and software to allow them to practise and demonstrate practical skills as evidence of learning. This will necessitate the provision of well-managed break-fix resources.

## Resources

### Books

Beisse F – *A Guide to Computer User Support for Help Desk and Support Specialists, International Edition* (Course Technology, 2009) ISBN-10: 1439042055

Bruton N – *How to Manage the IT Help Desk: A Guide for User Support and Call Center (Computer Weekly Professional)* (Butterworth Heinemann, 2002) ISBN-10: 0750649011

Gookin D – *Troubleshooting and Maintaining Your PC All-in-one Desk Reference for Dummies* (Wiley, 2009) ISBN-10: 0470396652

McRae K, Marshall G – *Computer Troubleshooting: The Complete Step-by-step Guide to Diagnosing and Fixing Common PC Problems* (Haynes & Co, 2008) ISBN-10: 1844255174

Sanchez A – *Technical Support Essentials: Advice to Succeed in Technical Support (Beginner to Intermediate)* (CA Press, 2010) ISBN-10: 1430225475

Wooton R – *Building and Running a World Class IT Help Desk* (McGraw Hill, 2001) ISBN-10: 007213237X

### Websites

[www.answerthatwork.com/](http://www.answerthatwork.com/)

[www.internet4classrooms.com/support.htm](http://www.internet4classrooms.com/support.htm)

## Employer engagement and vocational contexts

Working with a live system will present many risks, that the centre, employer and learner must be aware of using a current vocational context to deploy an additional or alternate solution will enhance the learners experience and enable understanding of wider technical application.



## Unit 29: e-Commerce Strategy

**Unit code:** T/601/1994

**QCF Level 5:** BTEC Higher National

**Credit value:** 15

- **Aim**

To enable learners to understand how businesses and organisations develop e-Commerce strategies to remain competitive in the global market.

- **Unit abstract**

This unit starts by considering customers' expectations of e-Commerce, because these will dictate implementation priorities.

When planning an e-Commerce strategy, it is necessary to assess the current status of the business information and logistics systems because these will provide the foundation for e-Commerce. Preparations will also be necessary to meet the standards of support that e-customers expect. Marketing, promotion and supply chain management must all be considered, alongside the website, when developing an implementation strategy.

In managing an e-Commerce strategy, considerations include protecting the intellectual property of the business and maintaining the integrity of its website. This will require considerations of risk and the implementation of appropriate security precautions.

Finally in this unit learners will critically evaluate current developments in e-Commerce.

- **Learning outcomes**

**On successful completion of this unit a learner will:**

- 1 Understand the impact of e-Commerce on business
- 2 Be able to plan an e-Commerce strategy
- 3 Be able to manage an e-Commerce strategy.



## Unit content

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### 1 Understand the impact of e-Commerce on business

*Customer expectations:* raised expectations for a quick and efficient service eg timely responses to customer communications, quick delivery of the product or service, accurate information

*Common applications:* types eg payment systems, online shopping, shopping cart software, newsgroups, email

### 2 Be able to plan an e-Commerce strategy

*Strategy:* general eg marketing, supply chain, electronic payment

*Internet strategy:* hosting eg internal, sub-contracted; designing the website; maintaining 24/7 access

*Marketing strategy:* methods eg targeting market segments and interest groups, developing electronic 'web-communities', promotion strategies to target specific market segments, search engine optimisation, e-marketing software

*Supply chain strategy:* methods eg satisfying customer demand, responsive supply chain, managed in house or sub-contracted, developing 'partnership' relationships with suppliers

*Electronic payment:* methods eg online transaction processing, Commercial Off the Shelf Software (COTS), security; other payment systems eg PayPal, WorldPay

### 3 Be able to manage an e-Commerce strategy

*Intellectual property:* ownership eg domain name, company name, trade marks

*Assessment of security risks:* risks eg risk of linking business systems to the Internet

*Security measures:* propose security measures to minimise risks eg firewalls and use of intranets or extranets

*Current developments:* areas eg marketing, supply chain management, electronic payment

## Learning outcomes and assessment criteria

Learning outcomes On successful completion of this unit a learner will:	Assessment criteria for pass The learner can:
LO1 Understand the impact of e-Commerce on business	1.1 critically discuss the expectations of internet customers 1.2 critically assess the potential impact of common applications on an e-Commerce business
LO2 Be able to plan an e-Commerce strategy	2.1 plan an e-Commerce implementation strategy for an e-Commerce business
LO3 Be able to manage an e-Commerce strategy	3.1 critically assess the risks of linking business systems to the internet 3.2 explain the importance of protecting the intellectual property of an organisation 3.3 critically discuss security measures to protect an e-Commerce solution. 3.4 critically evaluate current e-Commerce developments and assess their incorporation into an e-Commerce strategy.

## Guidance

### Links to National Occupational Standards, other BTEC units, other BTEC qualifications and other relevant units and qualifications

The learning outcomes associated with this unit are closely linked with:

Level 3	Level 4	Level 5
Unit 3: Information Systems	Unit 1: Business Skills for e-Commerce	Unit 30: Information Systems in Organisations
Unit 8: e-Commerce	Unit 16: e-Commerce Technologies	
Unit 33: Exploring Business Activity		
Unit 34: Business Resources		

This unit has links to the Level 4 and Level 5 National Occupational Standards for IT and Telecoms Professionals, particularly the areas of competence of:

- Systems Analysis
- Systems Design
- Systems Development
- Change and Release Management
- Supplier Management.

## Resources

### Books

Chaffey, D – *E-Business and E-Commerce Management* (Prentice Hall, 2006) ISBN 9780273707523

Cumming, T – *Little e, Big Commerce* (Virgin Publishing, 2010) ISBN 9780753522899

Lauden, K C, Traver, C G – *E-Commerce: Business, Technology, Society* (Addison Wesley, 2002)  
ISBN: 032112202X

Schneider, G P – *Electronic Commerce* (Course Technology, 2006) ISBN 9781418837037

Turban, E et al – *Electronic Commerce* (Pearson Education, 2009) ISBN: 9780137034659

### Websites

<http://academic.cengage.com/coursestechnology>

[www.booksites.net](http://www.booksites.net)

[www.pearsonhighered.com/laudon](http://www.pearsonhighered.com/laudon)

## Employer engagement and vocational contexts

To further enrich the content of this unit and to provide more of a vocational context it would be beneficial to bring in guest speakers from a range of organisations. Speakers can discuss their e-Commerce system(s) in terms of the infrastructure, technologies and security aspects.



## Unit 30: Information Systems in Organisations

**Unit code:** M/601/1444

**QCF Level 5:** BTEC Higher National

**Credit value:** 15

- **Aim**

To provide learners with an understanding of how organisations use information systems to help them manage their specific needs.

- **Unit abstract**

Information is the most valuable resource that an organisation possesses. The effective gathering, protection, analysis, processing and dissemination of information is vital to the success of any organisation. As globalisation and the 24-hour economy develop and increase, organisations must ensure that their information systems are reliable, efficient and able to cope with rapid change.

Organisations whose information systems previously dealt purely with data processing have now introduced those supporting strategic management and decision support. Managers at all levels need appropriate and timely information to plan successfully in the short, medium and long term, and that information can have many sources and destinations. As organisations diversify and decentralise, information also needs to be available to many non-managerial staff in a variety of locations. The logical conclusion is that an organisation is now completely dependent on the effectiveness of its information systems in order to survive and thrive in the 21st century business environment.

Learners will begin this unit by analysing the information needs of an organisation at different levels and within different functional areas. It is important that computing professionals are able to understand how an organisation works and how it uses information, in order to be able to design, implement, maintain and manage systems to support its operation.

On completion of this unit, learners will understand the importance of effective information systems to an organisation. They will be aware of the variety of options available for information processing and know that these will inevitably change over time. They will also use an information system to produce management information.

- **Learning outcomes**

**On successful completion of this unit a learner will:**

- 1 Understand information needs within different functional areas of organisations
- 2 Be able to compare information systems
- 3 Be able to use information systems to produce management information.



## Unit content

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### 1 Understand information needs within different functional areas of organisations

*Functional areas of an organisation:* typical areas eg finance, accounts, human resources, stock control, sales, marketing, research and development, production, distribution, customer service, administration

*Information needs:* requirements analysis eg strategic, tactical, operational; data requirements eg inputs, outputs, processing activities; information distribution requirements eg location, department, individual

### 2 Be able to compare information systems

*Information systems:* types eg business information systems, decision support systems, management information systems, executive information systems, office information systems, transaction processing systems, expert systems, global information systems, data warehouse systems, enterprise systems, enterprise resource planning systems, integrated information systems

*Information and data:* definition of information and data, sources of information, information requirements and the needs for information at different levels within an organisation, storing information and its importance with regard to security, accuracy and relevance; outputs eg payroll, invoicing, ordering, bookings, stock control, personnel records, goods tracking, decision making, marketing, customer service

### 3 Be able to use information systems to produce management information

*Management information:* reports eg sales report, college enrolment statistics, marketing analysis (brick v click)

*Gathering information:* defining requirements; establishing sources of information; defining other factors to be considered eg constraints

*Selecting information:* analysis of eg validity, accuracy, currency, relevance; identifying alternatives

## Learning outcomes and assessment criteria

<b>Learning outcomes</b>  <b>On successful completion of this unit a learner will:</b>	<b>Assessment criteria for pass</b>  <b>The learner can:</b>
LO1  Understand information needs within different functional areas of organisations	1.1 evaluate the information needs of the different functional areas of an organisation
LO2  Be able to compare information systems	2.1 describe different types of information systems 2.2 investigate the current trends in using information systems applications to solve business problems 2.3 evaluate the suitability of information systems for different functional areas of an organisation
LO3  Be able to use information systems to produce management information	3.1 use an information system to generate valid, accurate and useful information for a given problem 3.2 evaluate alternative methods of solving the problem.

## Guidance

### Links to National Occupational Standards, other BTEC units, other BTEC qualifications and other relevant units and qualifications

The learning outcomes associated with this unit are closely linked with:

Level 3	Level 4	Level 5
Unit 3: Information Systems	Unit 5: Emerging Technologies	

This unit has links to the Level 4 and Level 5 National Occupational Standards for IT and Telecoms Professionals, particularly the areas of competence of:

- Information Management.

### Essential requirements

Learners must have access to an information system.

### Resources

#### Books

Avison D, Fitzgerald G – *Information Systems Development: Methodologies, Techniques and Tools* (McGraw Hill, 2006) ISBN-10: 0077114175

Benyon-Davies P – *Business Information Systems* (Palgrave Macmillan, 2009) ISBN-10: 023020368X

Giarratano J, Riley G – *Expert Systems: Principles and Programming* (Course Technology, 2004) ISBN-10: 0534384471

Laudon J, Laudon K – *Essentials of Management Information Systems* (Pearson, 2008) ISBN-10: 0135013534

Pijpers G – *Information Overload: A System for Better Managing Every Day Data* (Microsoft Executive Leadership Series) (Wiley, 2010) ISBN-10: 0470625740

Turban E et al – *Decision Support and Business Intelligence Systems* (Pearson, 2008) ISBN-10: 0131580175

### Employer engagement and vocational contexts

To further enrich the content of this unit and to provide more of a vocational context, it would be beneficial to bring in guest speakers or use any conference footage that is available. The proceedings or coverage of any workshops may be quite engaging and informative.

## Unit 31: Knowledge-based Systems

**Unit code:** J/601/0459

**QCF Level 5:** BTEC Higher National

**Credit value:** 15

- **Aim**

The aim of this unit is to develop the learner's understanding of knowledge systems, their relationship with artificial intelligence and their utilisation by expert systems. Learners will use this understanding to develop a knowledge-based application.

- **Unit abstract**

Knowledge-based systems encompass expert systems tools and techniques and incorporate artificial intelligence. This area is rapidly expanding into new and advanced environments such as science, education and medicine where there is a need for more complex and sophisticated systems.

The types of system available are constantly evolving and it is the expectation that learners will engage in extensive research into existing and emerging technologies that fall under the umbrella of knowledge systems.

On completion of this unit, learners should be able to appreciate the value and contribution of knowledge-based systems and their importance in many critical environments. Learners will also engage with artificial intelligence languages, knowledge-based systems and shells to develop and design their own applications.

- **Learning outcomes**

**On successful completion of this unit a learner will:**

- 1 Understand knowledge-based systems
- 2 Be able to design knowledge-based applications
- 3 Be able to develop knowledge-based applications.

## Unit content

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### 1 Understand knowledge-based systems

*Knowledge base:* components eg data, rules and structure; human readable eg Microsoft troubleshooter software, FAQs; machine readable, structured data with entity relationships eg medical diagnostics, mortgage selection

*Knowledge management:* techniques eg data mining; gathering, organising, refining and disseminating information

*Artificial Intelligence (AI):* simulation of human intelligence by computer systems; use of knowledge bases within AI; traits eg reasoning, learning; applications of AI eg expert systems, speech recognition, share trading, video games, web search engines

*Expert systems:* inference rules; architecture; people eg end-user, subject matter expert, expert system engineer or programmer; applications eg medicine, financial services, accounting, chess

### 2 Be able to design knowledge-based applications

*Investigative techniques:* use a range of investigative techniques to review current applications

*System elements:* using a 'shell' as a framework for development eg eGanges

*Design and planning:* use of an appropriate design method eg rules, frames, nets

*Language elements:* skills as required for the language used

### 3 Be able to develop knowledge-based applications

*All development languages:* based on eg Lisp, Prolog, IPL, C++

*Development:* use of appropriate language to create an application; develop an application using the system/shell

*Testing:* test strategy; recording results

*Documentation:* documenting of the application to set standards

## Learning outcomes and assessment criteria

<b>Learning outcomes</b>  <b>On successful completion of this unit a learner will:</b>	<b>Assessment criteria for pass</b>  <b>The learner can:</b>
LO1  Understand knowledge-based systems	1.1 analyse a real-world knowledge-based system, detailing: <ul style="list-style-type: none"> <li>i data, rules and structure</li> <li>ii how the knowledge is managed</li> <li>iii how artificial intelligence traits are incorporated into the system</li> <li>iv how an expert system is created from utilising the knowledge base and including AI traits</li> </ul>
LO2  Be able to design knowledge-based applications	2.1 plan the design of an application using an AI development language  2.2 identify the screen components and data and file structures required to implement a given design  2.3 design knowledge base, rules and structure of the application
LO3  Be able to develop knowledge-based applications	3.1 implement the application  3.2 implement data validation for inputs  3.3 identify and implement opportunities for error handling and reporting  3.4 design and implement a test strategy  3.5 create documentation to support users.



## Guidance

### Links to National Occupational Standards, other BTEC units, other BTEC qualifications and other relevant units and qualifications

The learning outcomes associated with this unit are closely linked with:

Level 3	Level 4	Level 5
Unit 24: Controlling Systems using IT	Unit 9: Systems Analysis and Design	Unit 39: Computer Games Design and Development
	Unit 10: Human Computer Interaction	Unit 40: Distributed Software Applications
		Unit 41: Programming in Java
		Unit 42: Programming in .NET

This unit has links to the Level 4 and Level 5 National Occupational Standards for IT and Telecoms Professionals, particularly the areas of competence of:

- Human Needs Analysis
- Systems Analysis
- HCI Design
- Software Development
- IT Application Management/Support.

### Essential requirements

Learners must have access to a range of organisational environments that are using or planning on implementing a knowledge-based system. Specific commercial, medical or academic domains would also be of benefit as expert systems have already been established in these fields.

In addition to more traditional texts, journals and case studies would complement this unit. Learners must also keep up to date with current systems developments in the field.

## Resources

### Books

Akerkar R – *Knowledge Based Systems* (Jones and Bartlett, 2009) ISBN-10: 0763776475

Barski C – *Land of LISP* (No Starch Press, 2010) ISBN-10: 1593272006

Bratko I – *Prolog Programming for Artificial Intelligence, 3rd Edition* (Addison Wesley, 2000)  
ISBN-10: 0201403757

Negnevitsky M – *Artificial Intelligence: A Guide to Intelligent Systems* (Addison Wesley, 2004)  
ISBN-10: 0321204662

Seibel P – *Practical Common Lisp* (Apress, 2005) ISBN-10: 1590592395

### Employer engagement and vocational contexts

To further enrich the content of this unit and to provide more of a vocational context it would be beneficial to bring in analysts or employers from organisations that have had exposure to systems analysis.



## Unit 32: Quality Systems in IT

**Unit code:** D/601/1987

**QCF Level 5:** BTEC Higher National

**Credit value:** 15

- **Aim**

To provide learners with an understanding of the importance of the quality process as applied to IT-related systems development.

- **Unit abstract**

Quality control and assurance relies on the establishment of standards by which projects can be measured. This is carried out through reviews, tests and inspections to ensure that the end product meets requirements.

IT projects need to be carried out within a structured framework of procedures that will ensure that quality is an integral part of the development process. Adherence to this framework ensures that the final outcome meets its intended purpose and has been produced using the most efficient method.

Learners will begin this unit by exploring the meaning of quality in the context of IT development and the implications of adopting this approach. They will continue by learning about the quality control issues and then project management tools that can be used to support the process.

On completion of this unit, learners will understand the importance of a quality-focused approach to development and maintenance and be able to select appropriate tools to enable this.

- **Learning outcomes**

**On successful completion of this unit a learner will:**

- 1 Understand the need for quality assurance in IT systems
- 2 Be able to employ standard quality control documentation
- 3 Be able to use project management tools.

## Unit content

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### 1 Understand the need for quality assurance in IT systems

*Standards:* compliance against national and international standards eg ISO 31000 risk; risk management standards eg Project Management Institute, National Institute of Science and Technology; quality standards, ISO 9000, best practice

*Risks:* types of risk eg financial, project failure, legal, accidents, natural causes, attacks

*Systems Development Life Cycle:* stages eg planning, requirements analysis, design, build, test, maintenance

### 2 Be able to employ standard quality control documentation

*Documentation:* to include eg detailed product specification, environmental, safety, reliability, maintainability requirements, monitoring checks, reviews, inspections, test results, control charts

### 3 Be able to use project management tools

*Tools:* techniques eg Gantt charts, CPM, PERT, PRINCE, project management software

## Learning outcomes and assessment criteria

<b>Learning outcomes</b>  <b>On successful completion of this unit a learner will:</b>	<b>Assessment criteria for pass</b>  <b>The learner can:</b>
LO1  Understand the need for quality assurance in IT systems	1.1 discuss appropriate standards for the development of an IT system  1.2 assess the risks associated with the development of an IT system  1.3 discuss quality assurance practices at all stages of the systems development lifecycle
LO2  Be able to employ standard quality control documentation	2.1 produce quality control documentation for each stage of the systems development lifecycle
LO3  Be able to use project management tools	3.1 apply project planning and management tools to plan specific resources and requirements for an IT system development  3.2 evaluate the suitability of tools used to manage the development of an IT system.



## Guidance

### Links to National Occupational Standards, other BTEC units, other BTEC qualifications and other relevant units and qualifications

The learning outcomes associated with this unit are closely linked with:

Level 3	Level 4	Level 5
Unit 11: Systems Analysis and Design	Unit 8: Management of Projects	Unit 4: Project Design, Implementation and Evaluation
Unit 17: Project Planning with IT	Unit 9: Systems Analysis and Design	

This unit has links to the Level 4 and Level 5 National Occupational Standards for IT and Telecoms Professionals, particularly the areas of competence of:

- Change and Release Management
- IT/Technology Service Catalogue and/or Service Level Management
- Measurement and Reporting.

### Essential requirements

Learners must have access to suitable project planning and management tools.

### Resources

#### Books

Chatfield C, Johnson T – *Microsoft Office Project 2007 Step by Step Book/CD Package* (Microsoft Press, 2007) ISBN-10: 0735623058

Clark W – *The Gantt Chart, a Working Tool of Management* (2010) ISBN-10: 1152255762

Galin D – *Software Quality Assurance: From Theory to Implementation* (Addison Wesley, 2003) ISBN-10: 0201709457

Honey G – *A Short Guide to Reputation Risk (Short Guide to Business Risk)* (Gower, 2009) ISBN-10: 0566089955

Portney S – *Project Management for Dummies* (Wiley, 2006) ISBN-10: 0470049235

Reuvid J – *Managing Business Risk: A Practical Guide to Protecting Your Business* (Kogan Page, 2009) ISBN-10: 0749454490

#### Websites

[www.businessballs.com/project.htm](http://www.businessballs.com/project.htm)

[www.softwareqatest.com/qatlnks1.html](http://www.softwareqatest.com/qatlnks1.html)

**Employer engagement and vocational contexts**

To further enrich the content of this unit and to provide more of a vocational context, it would be beneficial to bring programmers or employers from organisations that have had exposure to expert systems or have been involved in their development.



## Unit 33: Data Analysis and Design

**Unit code:** H/601/1991

**QCF Level 5:** BTEC Higher National

**Credit value:** 15

- **Aim**

To provide learners with the knowledge and skills needed to understand, design, query and implement database systems.

- **Unit abstract**

An understanding of database tools and technologies is key to many of today's industries. Database systems are predominant in the world of IT, and continue to demand more complex data structures and interface, as applications get increasingly sophisticated.

Databases provide the infrastructure to many organisations, and they offer support to key business applications and information systems. The most common database model used commercially is the relational one.

The aim of this unit is to provide a knowledge and understanding of database systems including design principles, practical implementation and development skills for both the system designer and software engineer. The importance of structured query languages should be stressed, in terms of how they can be used to manipulate data and how they are used for a variety of tasks including querying and report writing.

On completion of this unit the learner should be able to understand, design, query and implement a database(s). Learners will also have a theoretical insight into the requirement for designing a database that meets a given user or system requirement and that is functional, user friendly and robust.

- **Learning outcomes**

**On successful completion of this unit a learner will:**

- 1 Understand data models and database technologies
- 2 Be able to design and implement relational database systems
- 3 Be able to use manipulation and querying tools
- 4 Be able to test and document relational database systems.

## Unit content

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### 1 Understand data models and database technologies

*Data models:* Hierarchical; Network; Relational; data manipulation languages; data definition languages; data independence; data redundancy issues; data integrity; schema; eg tables fields relationships, views, indexes; conceptual scheme; physical scheme, data dictionary.

*Approaches:* top down and bottom up; tools and techniques eg entity analysis, Entity Relation Diagrams (ERDs), determinancy diagrams, data flow diagrams; entities; attributes and key identifiers; relationship types and enterprise rules; degrees of relationships; functional dependency; first, second and third normal forms

*New developments:* dynamic storage; data mining and data warehousing; web enabled database applications; other developments eg multimedia databases, document management systems, digital libraries

### 2 Be able to design and implement relational database systems

*Designs:* data types; entity and referential constraints; conversion of logical database design to a physical implementation; tools and techniques; issues around the degree of normalisation chosen; verification and validity checks; data definition; control mechanisms

*Requirements:* requirements specification; relational requirements; other requirements eg need to integrate with legacy systems, future requirements, timescales, costs.

*User interface:* requirements eg functionality, reliability, consistency, performance, menu driven, HCI interface

### 3 Be able to use manipulation and querying tools

*Data manipulation:* query languages; visual tools; typical tasks eg for database maintenance, inserts, updates and amendments

*Queries and reporting:* query languages and query by example (QBE); formatting; functions/formulae; report writing tools

### 4 Be able to test and document relational database systems

*Control mechanisms.* example systems eg TQM(Total Quality Management); connection to requirements specification; sign off procedures.

*Testing procedures:* test plans; test models eg white box, black box; test documentation; other eg organisational requirements; user documentation eg help menu, pop-ups, hot-spots

## Learning outcomes and assessment criteria

Learning outcomes  On successful completion of this unit a learner will:	Assessment criteria for pass  The learner can:
LO1  Understand data models and database technologies	1.1 critically compare different data models and schemas 1.2 critically discuss the benefits and limitations of different database technologies 1.3 analyse different approaches to database design
LO2  Be able to design and implement relational database systems	2.1 design a relational database system to meet a given requirement 2.2 build a relational database system based on a prepared design 2.3 apply a range of database tools and techniques to enhance the user interface
LO3  Be able to use manipulation and querying tools	3.1 explain the benefits of using manipulation and query tools in a relational database system 3.2 implement a query language into the relational database system 3.3 critically evaluate how meaningful data has been extracted through the use of query tools
LO4  Be able to test and document relational database systems	4.1 critically review and test a relational database system 4.2 create documentation to support the implementation and testing of a relational database system 4.3 create user documentation for a developed relational database system 4.4 explain how verification and validation has been addressed 4.5 explain how control mechanisms have been used.



## Guidance

### Links to National Occupational Standards, other BTEC units, other BTEC qualifications and other relevant units and qualifications

The learning outcomes associated with this unit are closely linked with:

Level 3	Level 4	Level 5
Unit 21: Data Analysis and Design	Unit 17: Database Design Concepts	

This unit has links to the Level 4 and Level 5 National Occupational Standards for IT and Telecoms Professionals, particularly the areas of competence of:

- Data Analysis
- Data Design.

### Essential requirements

Learners must have access to database software.

### Resources

#### Books

Avison D and Fitzgerald G – *Information Systems Development: Methodologies, Techniques and Tools* (McGraw Hill Higher Publishing Company, 2006) ISBN 0077114175

Chao L – *Database Development and Management* (CRC Press, 2006) ISBN 0849392381

Connolly T and Begg C – *Database Systems: A Practical Approach to Design, Implementation and Management* (Addison Wesley, 2004) ISBN 0321210255

Howe D – *Data Analysis for Database Design* (Butterworth-Heinemann Ltd, 2001) ISBN 0750650869

Kroenke D – *Database Concepts, 2nd Edition* (Prentice Hall, 2004) ISBN 0131451413

Ponniah P – *Database Design and Development: An Essential Guide for IT Professionals: Visible Analyst Set* (John Wiley & Sons Inc, 2006) ISBN 0471760943

Ritchie C – *Relational Database Principles* (Thomson Learning, 2002) ISBN 0826457134

#### Websites

[www.deeptraining.com/litwin/dbdesign/FundamentalsOfRelationalDatabaseDesign.aspx](http://www.deeptraining.com/litwin/dbdesign/FundamentalsOfRelationalDatabaseDesign.aspx)

[www.geekgirls.com/menu\\_databases.htm](http://www.geekgirls.com/menu_databases.htm)

[www.smart-it-consulting.com/database/progress-database-design-guide/](http://www.smart-it-consulting.com/database/progress-database-design-guide/)

**Employer engagement and vocational contexts**

To further enrich the content of this unit and to provide more of a vocational context it would be beneficial to bring in guest speakers, such as database designers, end users and administrators to discuss their role within an organisation(s) and the importance of good database design.



## Unit 34: Data Structures and Algorithms

**Unit code:** H/601/1456

**QCF Level 5:** BTEC Higher National

**Credit value:** 15

- **Aim**

This unit provides learners with an understanding of how data structures are used in algorithms and enables them to design and implement data structures.

- **Unit abstract**

The unit starts by introducing abstract data types and explores their use in data structures. Based on this knowledge and understanding, learners should be able to develop solutions, using data structures for a range of commercial needs. Data structures may be implemented using a variety of programming paradigms and learners may use one or more areas for their implementations.

Finally, learners will research commercial applications that incorporate data structures and evaluate their use.

On completion of this unit the learner should be able to design and implement a variety of data structures and be able to evaluate different algorithms that implement data structures.

- **Learning outcomes**

**On successful completion of this unit a learner will:**

- 1 Understand data structures and algorithms
- 2 Be able to implement data structures and algorithms
- 3 Understand how strings are structured and processed.

## Unit content

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### 1 Understand data structures and algorithms

*Data structures:* array; set; stack; queue; list; tree; types eg active, passive, recursive.

*Operations:* types eg create, empty, push, pop, insert, delete, search, sort.

*Design specification:* using non-executable programme specification language eg pseudo code; issues eg complexity in software development; interfaces; information hiding.

*Creation:* pre-conditions, post-conditions, error-conditions.

*Algorithms:* sort eg insertion, quick, shell, merge, heapsort, selection sort; search eg linear, binary, binary search tree; recursive eg binary tree traversals (preorder, inorder, postorder).

### 2 Be able to implement data structures and algorithms

*Implementation:* sorting, searching and recursive algorithms; using eg arrays (single and/or multi dimensional), handle, pointer, class, methods; using an executable programming language.

### 3 Understand how strings are structured and processed

*String:* structure eg sequence of characters, data type, character encoding.

*Operations:* types eg concatenation, find character, length, lowercase, substring, trim.

*Algorithms:* processing eg string searching, string sorting, string manipulation.

## Learning outcomes and assessment criteria

Learning outcomes On successful completion of this unit a learner will:	Assessment criteria for pass The learner can:
LO1 Understand data structures and algorithms	1.1 produce design specification for data structures explaining the valid operations that can be carried out on the structures 1.2 explain the operation and performance of sorting and search algorithms 1.3 explain the operation of recursive algorithms and identify situations when recursion is used
LO2 Be able to implement data structures and algorithms	2.1 implement data structures in an executable programming language in the context of well-defined problems 2.2 implement opportunities for error handling and reporting 2.3 test results to enable comparison with expected results
LO3 Understand how strings are structured and processed	3.1 explain common string operations and their practical applications 3.2 demonstrate the outcome of string operations in specified algorithms.



## Guidance

### Links to National Occupational Standards, other BTEC units, other BTEC qualifications and other relevant units and qualifications

The learning outcomes associated with this unit are closely linked with:

Level 3	Level 4	Level 5
	Unit 18: Procedural Programming	Unit 40: Distributed Software Applications
	Unit 19: Object Oriented Programming	Unit 41: Programming in Java
	Unit 20: Event Driven Programming Solutions	Unit 42: Programming in .NET
	Unit 21: Software Applications Testing,	
	Unit 22: Office Solutions Development	
	Unit 23: Mathematics for Software Development	

This unit has links to the Level 4 and Level 5 National Occupational Standards for IT and Telecoms Professionals, particularly the areas of competence of:

- Data Design
- Software Development.

### Resources

#### Books

Goodrich M, Tamassia R – *Data Structures and Algorithms in C++* (Wiley, 2010)  
ISBN-10: 0470383275

Goodrich M, Tamassia R – *Data Structures and Algorithms in Java* (Wiley, 2005)  
ISBN-10: 0471738840

Melhorn K, Sanders P – *Algorithms and Data Structures: The Basic Toolbox* (Springer, 2008)  
ISBN-10: 3540779779

#### Websites

<http://ww3.datastructures.net>

<http://www.itl.nist.gov/div897/sqg/dads/>

**Employer engagement and vocational contexts**

To further enrich the content of this unit and to provide more of a vocational context it would be beneficial to bring in programmers or designers from organisations that have engaged with data structures and algorithms within their systems.



## Unit 35: Web Applications Development

**Unit code:** K/601/1510

**QCF Level 5:** BTEC Higher National

**Credit value:** 15

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- **Aim**

To enable learners to understand the concepts of web applications and apply the skills to develop and test web applications using server-side technologies.

- **Unit abstract**

The internet has emerged as a dominating area of IT development. The ever-expanding applications within the global community that communicates, trades and exchanges information (seamlessly) has meant that the Internet and its associated technologies is a rapidly growing and changing area that requires in-depth knowledge as well as a wide range of skills. These web technologies have also been used to develop e-Commerce, intranet, extranet and social networking systems to meet the needs of modern businesses and associations.

Learners should already be familiar with website design and management, and will be able to apply their own web development skills to this unit. Learners will enjoy extending their web-development skills by understanding the concepts of web-based applications using server-side technologies. This unit takes client-side web-development one step further by introducing server-side application development. This unit focuses on server-side technologies and how server-side scripting can be used to create sophisticated web-based applications.

Learners will understand the concepts of web-based applications using one or more different server-side scripting languages, such as ASP, JSP and PHP. Many web-based systems also include database systems, which enables data to be processed dynamically. Learners will gain experience of developing web-enabled database systems, using SQL statements combined with server-side scripts to manage the process of information.

Learners will develop skills in specific techniques and also able to select when and where they are most appropriate, basing this decision on client and user needs. They will also ensure that their applications comply with the relevant legislation and guidelines.

- **Learning outcomes**

**On successful completion of this unit a learner will:**

- 1 Understand the concepts of web application development
- 2 Be able to design web applications
- 3 Be able to implement web applications
- 4 Be able to test web applications.

## Unit content

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### 1 Understand the concepts of web application development

*Users:* types eg expert, regular, occasional, novice, special needs; requirements, eg psychological, cultural, social and environmental, health and safety, education and work

*Site analysis:* purpose eg communication, real-time information, commercial, government, education, business, entertainment, downloading/uploading, web storage; fit for purpose, eg meets organisational and site objectives; planning, eg storyboarding, structure, hypermedia linkage, search engine key words, graphical design, user interface, audio/video sources, animation, text design; maintenance, eg plans, logs, disaster recovery, testing

*Accessibility:* features eg alternative text, resizable fonts, support for screen readers, adjustable fonts

*Legislation:* laws, guidelines and standards, eg Disability Discrimination Act, Data Protection Act, E-Commerce Regulations Act, W3C validation, copyright and intellectual property rights

*Functionality:* functions, eg shopping cart, reserve order, manage user profile, web content management, upload files

*Scripting languages:* server-side eg ASP (Active Server Pages), ASP.NET, PHP (Hypertext Preprocessor), JSP (Java Server Pages), Cold Fusion, Perl, Java Applet, Flash; advantages eg faster processing time, data processing, data storage; client-side eg JavaScript, VBScript

*Security:* security requirements, eg user accounts, account restrictions, procedures for granting and revoking access, terms of use, system monitoring

### 2 Be able to design web applications

*Identification of need:* nature of interactivity eg online transactions, static versus dynamic; client needs and user needs, eg image; level of security, eg user/administrator access; development timescales, support and maintenance contracts, costs, visibility on search engines; end user need eg appropriateness of graphics, complexity of site, delivery of content

*Design tools:* concept designing, eg mood boards, storyboarding; layout techniques eg frames, tables, block level containers (DIV), inline containers (SPAN); templates; colour schemes; screen designs, use case diagrams, pseudo code; other eg outline of content; database design, eg data flow diagrams, entity relationship diagrams

*Database design:* documenting the design; back end design, eg defining relationships, normalisation, naming conventions; front end design, eg user interface, security measures

### 3 Be able to implement web applications

*Structure:* layout of pages; navigation; format of content and cascading style sheets (CSS); page elements, eg headings, rules, frames, buttons, text and list boxes, hyperlinks/anchors, graphical images, clickable images/maps; interactive features, eg catalogue of products, shopping cart; images and animation

*Content:* proofed, correct and appropriate; reliability of information source; structured for purpose, eg prose, bullets, tables

*Development:* mark-up languages eg HTML (Hypertext Mark-up Language), DHTML (Dynamic Hypertext Mark-up Language); client-side scripting languages eg JavaScript, VBScript; features and advantages of software languages; web authoring software tools

*Tools and techniques:* navigation diagram eg linear, hierarchy or matrix; building interactivity tools, eg pseudo-code for client-server scripting; adding animation and audio/visual elements; ensuring compliance with W3C; meta-tagging; cascading style sheets

*Server-side interaction:* manage and process data, eg client, server; action events, action responses, login/logout

*Server-side scripting languages:* ASP, JSP, PHP, Cold Fusion, Perl

*Database connectivity:* common methods of using/accessing databases on a web server eg SQL (Structured Query Language), MySQL, ODBC (Open Database Connectivity), JDBC (Java Database Connectivity), ADO (ActiveX Data Objects).

*Web-programming concepts:* objects, eg response, request, application, session, server, error, file system, text stream, drive, file, folder, dictionary, ADO; components, eg email, file, file uploads, date/time; syntax, variables, procedures, forms, cookies, sessions, applications.

### 4 Be able to test web applications

*Review:* functionality testing (user environments, links and navigation); content; check against user requirements; user acceptance; audit trail of changes.

*Mechanisms:* browser compatibility testing, platform testing, script-language testing; valid HTML, server-script and database-script code; checking functionality against requirements, check internal and external hyperlinks to other web pages and media content (web files, web documents, images), error detection, error messages, dry running.

*Feedback:* record feedback, eg surveys, questionnaire, interviews; analyze feedback; present results

*Supportive documentation:* test plan (test data, expected results, actual results); test results; programmer guidance; user guidance (instructions)

*Testing by:* types eg administrator, user, automated scripts.



## Learning outcomes and assessment criteria

Learning outcomes  On successful completion of this unit a learner will:	Assessment criteria for pass  The learner can:
LO1 Understand the concepts of web application development	1.1 critically evaluate the functions and advantages of web applications 1.2 critically compare different types of server-side and client-side scripting languages 1.3 examine web security concerns and make recommendations for security improvements
LO2 Be able to design web applications	2.1 design a web application to meet a given requirement 2.2 synthesise client-side and server-side functionality in a web application 2.3 apply a database design for use in a web application 2.4 evaluate alternative designs and solutions to meet a given requirement
LO3 Be able to implement web applications	3.1 implement a web application to a prepared design using client-side and server-side scripting languages 3.2 implement a web-enabled database management system to store, retrieve and manipulate data in a web application 3.3 identify and implement opportunities for error handling and reporting
LO4 Be able to test web applications	4.1 critically review and test a web application using a web-enabled database management system 4.2 analyse actual test results against expected results to identify discrepancies 4.3 critically evaluate independent feedback on a developed web application and make recommendations for improvements 4.4 create user documentation for a developed web application.

## Guidance

### Links to National Occupational Standards, other BTEC units, other BTEC qualifications and other relevant units and qualifications

The learning outcomes associated with this unit are closely linked with:

Level 3	Level 4	Level 5
	Unit 14: Website Design	Unit 39: Computer Games Design and Development
	Unit 15: Website Management	Unit 40: Distributed Software Applications
	Unit 18: Procedural Programming	Unit 41: Programming in Java
	Unit 19: Object Oriented Programming	Unit 42: Programming in .NET
	Unit 20: Event Driven Programming Solutions	
	Unit 21: Software Applications Testing	
	Unit 22: Office Solutions Development	
	Unit 23: Mathematics for Software Development	

This unit has links to the Level 4 and Level 5 National Occupational Standards for IT and Telecoms Professionals, particularly the areas of competence of:

- Human Computer Interaction
- IT/Technology Infrastructure Design and Planning
- Software Development.

## Essential requirements

Learners will need access to a web server with any required software installed and configured eg Apache, PHP, IIS, ASP, in and outside of a classroom environment.

Learners must have access to facilities which will give them the opportunity to fully evidence all of the criteria in the unit. Learners must already be equipped with the fundamental skills of website design, development and management using client-side technologies.

Learners must be introduced to the fundamentals of web-based programming, and see examples of how web-based applications are developed using different server-scripting languages, such as ASP, JSP or PHP. Learners must also understand how data is processed between client, server and database systems, and recognise the flow of information. Database systems are also a fundamental aspect of web-application development, and learners must know how these systems are integrated.

Once the understanding and knowledge coverage has been achieved, learners are in a position to start developing their own web-based applications. Similarly to website development, learners need to be able to show that they can apply design skills first before building a web-based application.

Learners must be taught the required programming and database skills given in the unit content to enable them to develop a web-based application, which fulfils the assessment criteria. Learners will need to understand the fundamentals of SQL, and integrate a database system into their web-based application.

Evaluation and review continues to be an important theme throughout the web development units, and learners must be encouraged to evaluate throughout the entire process of creating a web-based application. Thorough testing must be performed on their web-based application, to ensure that it is fit for purpose and meets the requirements/specification.

## Resources

### Books

Hurwitz D, MacDonald B – *Learning ASP.NET 3.5* (O'Reilly Media, 2008) 978-0596518455

Nixon R – *Learning PHP, MySQL, and JavaScript* (O'Reilly Media, 2009) 978-0-596-15713-5

Parsons D – *Dynamic Web Application Development Using XML and Java* (Thompson Learning, 2008) ISBN-10: 1844805417

Schwartz R et al – *Learning Perl* (O'Reilly Media, 2008) ISBN-10: 0596520107

Stobart R – *Dynamic Web Application Development Using PHP and MySQL* (Thompson Learning, 2008) ISBN-10: 1844807533

### Websites

W3Schools Online Web Tutorials – [www.w3schools.com](http://www.w3schools.com)

## Employer engagement and vocational contexts

Working with a local web design/development-based organisation or using internet-based open source projects would enhance the learners' experience and offer a relevant vocational context.

## Unit 36: Internet Server Management

**Unit code:** A/601/1513

**QCF Level 5:** BTEC Higher National

**Credit value:** 15

### ● Aim

To enable learners to implement and manage secure internet technologies for networking systems.

### ● Unit abstract

As more organisations adopt internet-aware software there is an increasing need to understand the implications of internet technologies. In addition many organisations are now creating their own internet and intranet sites and therefore the successful management of sites and servers is becoming fundamental to network managers. The aim of this unit is to provide an introduction to internet server management within the context of a network operating system.

Internet technologies play an important role in all modern businesses operations. They are used extensively to strengthen the competitive edge of organisations and businesses and their position in the current marketplace climate. They allow businesses not just to market their products and services, but also to undertake business transactions with their partners and customers.

Internet servers are the backbone on which these internet technologies are implemented; these servers are at the heart of modern business operations. In this unit learners will discuss and analyse modern internet technologies used to establish internet services such as web, FTP, mail, proxy, certificate servers, directory servers, and many others. Learners will install, maintain and secure internet servers using tools and techniques available.

### ● Learning outcomes

**On successful completion of this unit a learner will:**

- 1 Understand internet technologies
- 2 Understand internet server architectures
- 3 Be able to implement internet server and services
- 4 Be able to manage internet server and services.

## Unit content

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### 1 Understand internet technologies

*Internet technologies and communication protocols:* protocols eg TCP/IP (Transmission Control Protocol/Internet Protocol), OSI (Open Systems Interconnection), DNS (Domain Name System), DHCP (Dynamic Host Configuration Protocol), SNMP (Simple Network Management Protocol); routing and remote access; telnet; ports and addresses; internet organisations eg ICANN (Internet Corporation for Assigned Names and Numbers), InterNIC (Internet Network Information Center), IEEE (Institute of Electric and Electronic Engineers); subnetting and supernetting

*Internet services:* services, eg intranet, email, e-Commerce, instant messaging, wikis, blogs, certificate services, directory services; internetworking servers eg ISP (Internet Service Provider), World Wide Web, FTP (File Transmission Protocol), database servers, e-Commerce servers, news servers, email servers, proxy servers, media servers, directory servers

*Networking technologies and concepts:* devices, eg hub, switch routers; network management concerns, eg client/server environment, user and group management, resources management, security, network attacks, firewall, ethical and legal issues, servers and server performances, user access issues

### 2 Understand internet server architectures

*Internet server technologies:* architecture eg modular; server structure eg core units, basic functionality, request handling mechanisms, performance and access issues; examples eg IIS (Internet Information Services), Apache

*Hardware and software:* required components eg CPU (Central Processing Unit), memory, storage devices, network connectivity, operating system; cost of running an internet server

### 3 Be able to implement internet server and services

*Planning installation:* procedures, eg examine and evaluate network infrastructure, select a suitable internet server, undertake pre installation activities, eg downloading and extracting the required files, preparing the required installation scripts, configuring the network server and the operating system for internet server inclusion; plan server required information, eg domain names, URLs (Uniform Resource Locators); consider customisation issues

*Installation:* tools eg GUI (Graphical User Interface) and command line; activities eg create web site, create virtual directory, install FTP services, create FTP sites

*Configure internet services:* services eg web services, FTP, SMTP (Simple Mail Transfer Protocol), proxy; certificate authority; configure site properties eg site bindings, IP (Internet Protocol), address hosting, port numbers hosting, host header hosting, default document filenames, directory browsing; publish websites

*Testing:* documentation, eg test plan (test data, expected results, actual results); test results

#### 4 Be able to manage internet server and services

*Websites and services:* web applications eg CGI (Common Gateway Interface), ISAPI (Internet Server Application Programming Interface); server-side eg Active Server Pages (ASP), ASP.NET; activities eg installing UDDI (Universal Description, Discovery and Integration), configuring FTP, SMTP and other services, implement and secure network access

*Internet services security:* activities eg configuring web site security; configuring IP address and domain name restrictions, enabling and configuring authentication methods, configuring anonymous access, using operating system authentication, enabling forms authentication, creating URL authorisation rules, using access control and file permissions, enabling and implementing certificate authentication and creating certificates Using VPN (Virtual Private Network) and secure sockets layer to protect integrity and authenticity and data exchange

*Monitoring and troubleshooting:* procedures eg configuring sites and applications logging, configuring centralised and remote logging, identifying log file and format, analysing log file; trace and diagnose problems; troubleshoot and solve common problems; monitor internet server performance; use server tools to measure and enhance internet server resources performance; document internet servers and services configurations and usage

## Learning outcomes and assessment criteria

Learning outcomes  On successful completion of this unit a learner will:	Assessment criteria for pass  The learner can:
LO1 Understand internet technologies	1.1 critically evaluate different internet technologies and communication protocols 1.2 critically compare different internet services and internetworking servers 1.3 discuss network management concerns and make recommendations to sustain network security, reliability and performance
LO2 Understand internet server architectures	2.1 critically analyse different internet server technologies and their performance 2.2 explain the hardware and software components of an internet server
LO3 Be able to implement internet server and services	3.1 produce a system specification to meet a given requirement 3.2 evaluate the suitability of internet server components 3.3 build and configure an internet server including services to meet a given requirement 3.4 critically review and test an internet server
LO4 Be able to manage internet server and services	4.1 install and manage websites and services to meet a given requirement 4.2 implement secure network access to meet a given requirement 4.3 monitor and troubleshoot an internet server and services 4.4 critically evaluate the performance of an internet server.



## Guidance

### Links to National Occupational Standards, other BTEC units, other BTEC qualifications and other relevant units and qualifications

The learning outcomes associated with this unit are closely linked with:

Level 3	Level 4	Level 5
	Unit 24: Networking Technologies	Unit 44: Local Area Networking Technologies
	Unit 25: Routing Concepts	Unit 45: Wide Area Networking Technologies
	Unit 26: Design a Small or Home Office Network	Unit 46: Networking Security
	Unit 27: Network Operating Systems	

This unit has links to the Level 4 and Level 5 National Occupational Standards for IT and Telecoms Professionals, particularly the areas of competence of:

- IT/Technology Infrastructure Design and Planning
- Systems Development
- Security Management
- IT/Technology Service Operations and Event Management
- IT/Technology Problem Management
- IT Application Management/ Support
- IT/Technology Management and Support.

### Essential requirements

**Hardware:** up-to-date hardware, computer and network systems that allow learners the opportunity to experiment with client/server based network, redundancy and the use of performance monitoring tools.

**Software:** latest network operating system with built in or add on internet servers and services based on either proprietary or open source software or both, to allow learners the ability to compare and contrast.

## **Resources**

### **Books**

Bennett M et al – *Professional Microsoft FAST Search* (Wiley, 2010) ISBN-10: 0470584661

Comer D – *Hands-on Networking with Internet Technologies* (Addison Wesley, 2004)

ISBN-10: 0131486969

Donahue G – *Network Warrior* (O'Reilly Media, 2007) ISBN-10: 0596101511

Ford A – *Apache 2 Pocket Reference* (O'Reilly Media, 2008) ISBN-10: 0596518889

Miller M – *Internet Technologies Handbook: Optimizing the IP Network* (Wiley Blackwell, 2004)

ISBN-10: 0471480509

Olifer N, Olifer V – *Computer Networks: Principles, Technologies and Protocols for Network Design* (Wiley, 2005) ISBN-10: 0470869828

### **Employer engagement and vocational contexts**

Working with a live system will present many risks, that the centre, employer and learner must be aware of. Using a current vocational context to deploy an additional or alternate solution will enhance the learners' experience and enable understanding of wider technical application.

## Unit 37: Digital Image Creation and Development

**Unit code:** Y/601/6721

**QCF Level 5:** BTEC Higher National

**Credit value:** 15

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- **Aim**

This unit aims to develop skills and understanding in sourcing, creating, developing and managing digital images for specific purposes.

- **Unit abstract**

In this unit learners will work with digital image systems and equipment to produce digital images to a specified brief. They will learn key aspects of digital practice such as file naming conventions, storage, compression and output. They will also work with a range of input devices and software tools.

Learners will be encouraged to explore approaches to developing digital imagery that incorporate creativity and sound technical skills. Learners will evaluate their response to the set brief, and consider areas such as copyright and legislation in commercial and non-commercial contexts in contemporary practice.

Delivery will be primarily practical with the provision of demonstrations of software and hardware. In addition, theory sessions will facilitate learning in some topic areas, for example file size, formats, resolution and compression.

Learners will be encouraged to adopt an experimental approach to generating imagery. This will enable learners to broaden their creative experiences and their understanding of the creative and potentiality of digital imaging systems.

Tutors will provide a set brief, or facilitate learners in developing their own set brief that meets the requirements of the unit. Learners will prepare designs for images, capture images, save appropriately, and present evidence that demonstrates their understanding. There will be opportunities for learners to focus on the critical evaluation of their own work. This may involve peer group and/or tutor presentation and discussion.

It is anticipated that a major proportion of this unit will be practice-based, and thus learners should demonstrate competent use of digital imaging systems in the production of practical work. Thus documentary evidence for each outcome will include images, their evaluation, and supporting material that demonstrates knowledge and understanding.

● **Learning outcomes**

**On successful completion of this unit a learner will:**

- 1 Be able to create digital images for specific purposes
- 2 Be able to process digital images
- 3 Be able to manipulate digital images to meet requirements
- 4 Understand the use of digital images.

## Unit content

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### 1 Be able to create digital images for specific purposes

*Sources:* primary; secondary; recording; sampling

*Input devices:* eg cameras, scanners, external hard-drives, USB devices, mobile phones, video cameras

*Acquisition:* analogue eg continuous tone, transparent, opaque, monochrome, colour, line, halftone; digital eg photograph, .jpg, clip art, royalty-free stock photography, internet, creative commons, mobile phone, hand-held device

*Input fundamentals:* resolution eg screen, print, dpi, lpi, bits per pixels (bpp), CMOS systems, file size, file formats; cross-platform, eg PSD, TIFF, JPEG, GIF, PDF

### 2 Be able to process digital images

*Devices:* eg portable, online, archive, screen, proofing, printing

*File formats:* file naming conventions; file management; applications; image size; compression eg lossy and lossless, ISDN

*Processing fundamentals:* capture; file format; back-up; import; export; image size; resolution; canvas size; resolution; output; image modes eg RGB, CMYK, indexed colour, grayscale, duotone

*Transmission:* download; stream eg File Transfer Protocol (FTP)

### 3 Be able to manipulate digital images to meet requirements

*Tools, techniques and palettes:* software tools eg text, exposure, cropping, adjusting, painting, duplicating, levels, curves, colour balance, hue, saturation, layers, history, paths, masks, channels, filters

### 4 Understand the use of digital images

*Own work:* evaluate; constraints of brief; originality; aesthetics; context; meaning; emphasis

*Others' work:* commercial contexts; design; sources; aesthetics; context; meaning; emphasis

## Learning outcomes and assessment criteria

Learning outcomes On successful completion of this unit a learner will:	Assessment criteria for pass The learner can:
LO1 Be able to create digital images for specific purposes	1.1 identify sources for digital images 1.2 create digital images from sources for specific purposes
LO2 Be able to process digital images	2.1 identify file formats and fundamentals required to process image data 2.2 apply digital data management techniques to store imagery
LO3 Be able to manipulate digital images to meet requirements	3.1 use software tools to manipulate images 3.2 prepare image files for output
LO4 Understand the use of digital images	4.1 evaluate own use of digital images in meeting requirements 4.2 evaluate others' use of digital images in meeting specified purposes.

## Guidance

### Links to National Occupational Standards, other BTEC units, other BTEC qualifications and other relevant units and qualifications

The learning outcomes associated with this unit are closely linked with:

Level 3	Level 4	Level 5
Unit 30: Digital Graphics	Unit 11: Digital Media in Art and Design	Unit 38: 3D Computer Modelling and Animation
Unit 35: Digital Graphics for Interactive Media	Unit 12: 2D, 3D, and Time-based Digital Applications	
Unit 37: 2D Animation Production	Unit 13: Multimedia Design and Authoring	
	Unit 14: Website Design	

This unit has links to the Level 4 and Level 5 National Occupational Standards for IT and Telecoms Professionals, particularly the areas of competence of:

- Human Computer Interaction/Interface (HCI) Design.

### Essential requirements

Centres will need to provide access to hardware, software and peripheral devices, to enable learners to gain practical knowledge and skills.

### Employer engagement and vocational contexts

There is the potential for centres to offer a live project or employer-led brief, where the requirements of the unit are addressed through a set brief that identifies real and tangible needs. Learners should be encouraged to work through the different stages of the set brief through presenting images and evaluating fitness for purpose of their ideas generation and digital developmental work, as well as their final outcomes.





## Unit 38: 3D Computer Modelling and Animation

**Unit code:** J/601/6780

**QCF Level 5:** BTEC Higher National

**Credit value:** 15

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### ● Aim

This unit aims to develop learners' skills and understanding of the principles and practical applications of 3D modelling and animation.

### ● Unit abstract

The unit supports learners to visualise and design three-dimensional space and object forms that exist within it. An appreciation of the requirements and applications of computer modeling and animation in commercial contexts may be used to inform learners' development of personal animation work. Learners may also consider the technical requirements for producing and distributing digital animation effectively. Learners should gain a working knowledge of 3D computer modeling and animation software, through applying techniques in their own animation work. Research elements of the unit allow learners to review the work of 3D computer artists.

Learners should develop creative responses to a set or self-generated brief, through exploring the potential offered by digital animation. Whilst the technical requirements of this field are demanding, learners should also be encouraged to reflect on creative approaches. Learners should work through stages such as visualisation and identifying technical requirements for scenes and models. Animation is a dynamic process, and learners may need to explore alternative approaches to be able to realise their creative intentions.

### ● Learning outcomes

**On successful completion of this unit a learner will:**

- 1 Understand how 3D computer modelling and animation are applied in commercial contexts
- 2 Be able to create a complex 3D scene
- 3 Be able to create a 3D model within a scene
- 4 Be able to produce 3D animations to meet a creative brief.

## Unit content

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### 1 Understand how 3D computer modelling and animation are applied in commercial contexts

*Productions:* interactive media; video; web; television; film; CGI; gaming; special effects; animation

*Production resources:* machine specification; memory requirements; rendering time; software

*Output:* download time; web-based; machine specification; end-user; interface

*Formats:* models; animations; environments; factors eg compression, workflow, assets, deliverables,

*Output requirements:* frames eg per second, size, rate; resolution; colour depth; initialising; bandwidth, real-time; streaming; downloading

*Evaluate:* purpose eg commercial, artistic, target audience, interactivity; context eg communication, entertainment, promotion, marketing, advertising; references eg work of others, animation studios, mainstream studios, independent animators

### 2 Be able to create a complex 3D scene

*Tools:* V plane; H plane; scale; stretch; link; unlink; render; zoom; navigate

*Objects:* geometric eg cube, sphere, cylinder; light objects; camera objects; adding; deleting; naming; aiming

*Lights:* colours; intensity; types; invisible; positioning; rotating

*Render modes:* ray trace; shade best; phong; gouraud; wireframe

*Techniques:* select; link; unlink; render

*Scene:* visualize; location eg interior, exterior; type eg natural, scientific, imaginative, realistic, architectural, environment; references eg historical, contemporary; textures

*Technical issues:* files; formats; compression; output; memory

### 3 Be able to create a 3D model within a scene

*Objects:* extrude; freeform; spline; lathe

*Editing objects:* spline form; path view; cross-section

*Linking:* hierarchy eg parent, child; grouping; ungrouping

*Surfaces:* applying; editing; composing; properties; maps; images; layers

*Techniques:* Boolean facility; environment maps; rigging; motion capture

*Create:* visualize; select sources eg subject, photography, drawings, models, own work, work of others; apply visual language eg shape, form, scale, colour, contrast

**4 Be able to produce 3D animations to meet a creative brief**

*Animation tools:* sequencer eg preview, spool, time bar, timelines, eventmarks; adding; deleting; overlapping; motion paths eg spline-based, linear; velocity eg graphs, control; keyframes; gravity control; simulators

*Types:* animation eg character, product; capture eg motion, performance

*Animation techniques:* morphing; kinematics; animating lights; texture mapping; rigging, tweening

*Produce:* sources eg images, characters, subject; themes eg narrative, action; factors eg clarity, detail, sound, humour, irony

*Evaluate:* planning; intuition; response; choices eg technology; format, visual language

## Learning outcomes and assessment criteria

Learning outcomes On successful completion of this unit a learner will:	Assessment criteria for pass The learner can:
LO1 Understand how 3D computer modelling and animation are applied in commercial contexts	1.1 Evaluate the application of 3D computer modelling and animation in a commercial context 1.2 Analyse technical requirements for 3D computer modelling and animation in a commercial context
LO2 Be able to create a complex 3D scene	2.1 Develop a complex scene using available geometric objects 2.2 Select tools and techniques appropriate to creative intentions
LO3 Be able to create a 3D model within a scene	3.1 Use editing tools to create custom objects. 3.2 Apply knowledge of hierarchy and linking 3.3 Modify an existing preset object to meet creative intentions
LO4 Be able to produce 3D animations to meet a creative brief	4.1 Use camera views creatively and effectively 4.2 Apply morphing techniques 4.3 Produce effective animation work that combines scenic and character elements.

## Guidance

### Links to National Occupational Standards, other BTEC units, other BTEC qualifications and other relevant units and qualifications

The learning outcomes associated with this unit are closely linked with:

Level 3	Level 4	Level 5
Unit 30: Digital Graphics	Unit 11: Digital Media in Art and Design	Unit 37: Digital Image Creation and Development
Unit 35: Digital Graphics for Interactive Media	Unit 12: 2D, 3D, and Time-based Digital Applications	
Unit 37: 2D Animation Production	Unit 13: Multimedia Design and Authoring	

This unit has links to the Level 4 and Level 5 National Occupational Standards for IT and Telecoms Professionals, particularly the areas of competence of:

- Human Computer Interaction/Interface (HCI) Design

### Essential requirements

Learners must have access to specialist facilities relevant to this unit.

### Employer engagement and vocational contexts

Centres should develop links with practising artists, craftspeople and designers, to deliver assignments to learners or to provide work experience. A lecture or visit by a web designer or design practitioner local to the centre may provide useful and pertinent information on working practice.

Links with employers are essential to the delivery of the programme for work experience and future employment. Assignments should be vocationally relevant; centres should consider the delivery of 'live projects' for example to support the vocational content of the unit and programme.





## **Unit 39: Computer Games Design and Development**

**Unit code:** Y/601/1518

**QCF Level 5:** BTEC Higher National

**Credit value:** 15

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### ● **Aim**

To provide learners with an understanding of computer games development as an underpinning technological concept in the fields of computer gaming and systems development.

### ● **Unit abstract**

It is often easy to forget that behind the polished high-definition graphics and increasingly cinematic content of modern computer games is a highly skilled team of designers and programmers. With more sophisticated environments and new ways of interacting with computers, computer game developers now have the choice to extend into many software development realms.

Linking to any of the programming units, this unit enables learners to use any suitable platform to explore design requirements and methods of user interaction as well as the coding demands required for the differing types of gaming environments. Whilst it is essential to offer learners an overview of the differing gaming environments, unit delivery for the development of a game should focus on one specific environment and the required user and technological interactions.

This unit is not suited to learners who do not have experience in programming and should ideally be delivered when the learner has completed procedural programming, object-oriented programming or event-driven programming.

### ● **Learning outcomes**

**On successful completion of this unit a learner will:**

- 1 Understand computer games development
- 2 Be able to design computer games
- 3 Be able to develop computer games
- 4 Be able to test and document computer games.

## Unit content

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### 1 Understand computer games development

*Types of computer game:* genre eg action, role-play, adventure, strategy, simulation, sports, combat, educational, puzzle, personal development, skills based; development areas eg graphics, Artificial Intelligence (AI), audio, role, scripting; interaction design eg Graphical User Interface (GUI), online, social, integration with media

*Platforms:* devices eg personal computer, hand held console, stand-alone platform, mobile phone, internet, network, web page

*Programming:* requirements eg mathematical, simulated physics, GUI components, interface

*User control:* interaction eg voice, movement, mouse, keyboard, touch screen, floor based, headset, simulated artifact

*Impact of gaming:* concerns eg time spent, social isolation, cost, separation of reality from actuality, addiction; benefits eg development of thinking, skills development, social interaction, impact on device development, impact on device accessibility

*Psychological factors:* effects eg use of sound, high score listings, competitive element, peer pressure, fun, educational value, expectations, personal development, skills acquisition

### 2 Be able to design computer games

*Design:* tools eg storyboards, pseudo code, narratives, action lists, graphical tools, actor interaction dialogues

*Development environment:* language eg event driven, object oriented, procedural; considerations eg development facilities, gaming resource offered, library availability, interaction resources, platform compatibility, platform portability

*Programming:* use of eg data types, conditional statements, control structures, objects, listeners, syntax rules, parameter passing

*Program design:* considerations eg purpose, modularity, systematic approach, data dictionary, structure charts, flow charts, pseudo code, state diagrams

*Units:* elements eg functions, procedures, methods, widgets, GUI components, symbols, avatars, characters

*Delivery:* environments eg desktop, application, mobile app, web based, utility, web based, applet, handheld, console based

**3 Be able to develop computer games**

*Implementation:* language eg event driven, object oriented, procedural; working application

*Programming:* use of programming standards; relationship to program design

*Coding:* use of conventional language commands; material produced is unique; use of library classes

*Pre-defined:* types eg class library, downloaded, imported, reversion code

*Complexity:* implementation of user interaction: assurance of user benefit; assurance of use

*Components:* features eg multimedia, sound, audio, visual, data management, file management

*Environment:* tools eg games programming software

**4 Be able to test and document computer games**

*Mechanisms:* procedures eg checking valid declarations, debugging code, checking naming conventions, checking functionality against requirements, error detection, error messages, compiler errors, runtime errors, in code response, dry running

*Supportive documentation:* test plan; test results; technical documentation eg data dictionary, action charts, action tables, input-process-output tables, class and instance diagrams, data flow diagrams; user guidance; game playing instructions

*Feedback:* record feedback, eg surveys, questionnaire, interviews; analyze feedback; present results

*Testing methods:* test strategy eg black box, white box, interface; iterative approach (testing at various stages of development); test plans and test cases; test logs; test evidence; test reports; retests done

## Learning outcomes and assessment criteria

Learning outcomes  On successful completion of this unit a learner will:	Assessment criteria for pass  The learner can:
LO1 Understand computer games development	1.1 critically compare different types of computer games and platforms 1.2 evaluate the characteristics of user interaction 1.3 evaluate the impact of computer-based gaming
LO2 Be able to design computer games	2.1 design a computer game for a given requirement 2.2 identify the components and data and file structures required to develop a computer game 2.3 evaluate alternative designs and solutions to meet a given requirement
LO3 Be able to develop computer games	3.1 implement a computer game to a given design using a suitable programming environment 3.2 implement components to meet design requirements 3.3 implement a game user interface to meet design requirements 3.4 identify and implement opportunities for error handling and reporting
LO4 Be able to test and document computer games	4.1 critically review and test a computer game 4.2 analyse actual test results against expected results to identify discrepancies 4.3 critically evaluate independent feedback on a developed computer game and make recommendations for improvements 4.4 create documentation for the installation, set-up and support for a developed computer game.

## Guidance

### Links to National Occupational Standards, other BTEC units, other BTEC qualifications and other relevant units and qualifications

The learning outcomes associated with this unit are closely linked with:

Level 3	Level 4	Level 5
Unit 22: Developing Computer Games	Unit 18: Procedural Programming	Unit 40: Distributed Software Applications
Unit 40: Computer Game Design	Unit 19: Object Oriented Programming	Unit 41: Programming in Java
	Unit 20: Event Driven Programming Solutions	Unit 42: Programming in .NET
	Unit 21: Software Applications Testing	
	Unit 23: Mathematics for Software Development	

This unit has links to the Level 4 and Level 5 National Occupational Standards for IT and Telecoms Professionals, particularly the areas of competence of:

- Software Development.

### Essential requirements

Whilst some games development systems and programming languages are commercially available, there are also free resources available incorporating an advanced set of gaming oriented features deployed on many platforms. You must ensure that in the case of mobile platforms the applicable free emulators are available or where security policies dictate, local work stations are equipped with virtualised operating systems containing the programming environment.

Learners must have access to facilities which allow them the opportunity to fully evidence all of the criteria of the unit. If this cannot be guaranteed then centres should not attempt to deliver this unit.

The learner must develop a game that has a level of interaction or challenge and may be applied on a range of platforms. Therefore it may be web based, GUI based, games console, mobile deliverable or a range of other platforms.

Implementation must be based on a suitably complex problem that ensures use of multiple actions and user interaction.

## Resources

### Books

Harbour J, Smith J and LaMothe A (editor) – *Beginner's Guide to Darkbasic Game Programming* (Muska & Lipman Publishing US, 2003) ISBN 1592000096

McShaffrey M – *Game Coding Complete, 2nd Edition* (Paraglyph Inc US, 2005) ISBN 1932111913

### Websites

Allegro	<a href="http://www.talula.demon.co.uk/allegro">www.talula.demon.co.uk/allegro</a>
Game Developer	<a href="http://www.gamedev.net">www.gamedev.net</a>
Game Programmer	<a href="http://www.gameprogrammer.com">www.gameprogrammer.com</a>
Game Programming Wiki	<a href="http://www.gpwiki.org">www.gpwiki.org</a>
Game Programming	<a href="http://en.wikipedia.org/wiki/Game_programming">en.wikipedia.org/wiki/Game_programming</a>
Game Tutorials	<a href="http://www.gametutorials.com">www.gametutorials.com</a>
The Game Creators	<a href="http://www.thegamecreators.com">www.thegamecreators.com</a>
Ultimate Game Programming	<a href="http://www.ultimategameprogramming.com">www.ultimategameprogramming.com</a>

## Employer engagement and vocational contexts

Working with a local programming-based organisation or using internet-based open source projects would enhance the learners' experience and offer a relevant vocational context.

## Unit 40: Distributed Software Applications

**Unit code:** M/601/1525

**QCF Level 5:** BTEC Higher National

**Credit value:** 15

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- **Aim**

To provide learners with an understanding of the principles of distributed computing, and apply the skills to design and build software applications delivered on distributed platforms.

- **Unit abstract**

Irrespective of framework or delivery platform, the development of distributed software applications is now at the core of many commercial applications development projects. Where no single resource contains the entire system and the client-server environment has moved to a more web-based and cloud-based solution.

This unit allows learners to become familiar with the underpinning concepts of distributed software applications design, without needing to develop particular skills in one chosen language. Each of the languages have the capacity to develop distributed and it is not important which language is chosen and can be based on the range of languages available in the qualification.

Content in this unit ties into skills developed in other programming units. All units may be delivered in partnership to offer the learner the best possible experience and scope for a larger project. As with all programming, the unit's focus of developing a distributed software application solution to meet identified needs is made along with one that emphasises the importance of testing and reviewing. Learners taking this unit may work on distributed video, networked applications or remote database calls amongst other systems.

- **Learning outcomes**

**On successful completion of this unit a learner will:**

- 1 Understand the principles of distributed computing
- 2 Be able to design distributed software applications
- 3 Be able to implement distributed software applications
- 4 Be able to test distributed software applications.



## Unit content

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### 1 Understand the principles of distributed computing

*Frameworks:* considerations eg selection of networking class libraries, selection of classes, identification of resources, suitability for system requirement; remote calls; data exchange; distribution system eg database, networked application, data exchange, web server, game, audio communication, video communication, data stream

*Communications:* specification eg protocols used, design of new protocols, data stream, use of networking class library, use of remote calls, use of database requests, framework interactions, DNS, addressing requirements, ports

*Interaction:* requirements eg selection of framework, language requirements, system requirements

*Security:* procedures eg remote access considerations, local defence, firewall rules, network traffic rules, Quality of Service (QoS) limitations

### 2 Be able to design distributed software applications

*Application:* selection eg identification of programming language, identification of libraries, selection of development environment

*Design methodology:* tactic eg reuse of existing resources, adaptation of code, use of open source

*Design method:* technique eg class responsibilities, collaboration cards, class diagrams, identification of dependencies and inheritances

*Specification:* contents eg input, output, processes, user needs, purpose, communications method

*Creation of application:* use of development environment; debugging

*Delivery environment:* device eg mobile, handheld, web based, desktop, dedicated device, server

*Interaction:* considerations eg remote exchange of data, local exchange of data, environment, compliance, compatibility, recognition of standards employed

*Communications:* specification eg bandwidth, protocol, compatibility, port, security considerations

### 3 Be able to implement distributed software applications

*Implement:* tools and techniques eg tool boxes and controls, selection, loops, event handlers, event driven triggers, listeners, objects and object properties, menus, debugging tools

*Data:* data types eg variables, declaring variables, scope of variables, constants

*Remote communication:* method eg use of existing methods, use of existing classes,

*Programming:* options eg use of methods, use of 'traditional coding', use of libraries

*Complexity:* complex techniques eg multiple classes, multiple code elements, remote communication

*IDE:* typical elements eg source code editor, compiler, interpreter, build automation tools, debugger

### 4 Be able to test distributed software applications

*Testing:* mechanisms eg valid declarations, debugging code, comment code, naming conventions, checking functionality against requirements, documentation

*Communications testing:* testing eg bandwidth, traffic analysis

*Errors:* handling eg management of extremes, use of system imposed statements, interaction between .Net classes

*Impact testing:* types eg range testing, input testing, load testing, system compatibility

*Documentation:* technical documentation eg designs, delivery system, platform, environment, file structures, coding, constraints, maintenance requirements

## Learning outcomes and assessment criteria

Learning outcomes  On successful completion of this unit a learner will:	Assessment criteria for pass  The learner can:
LO1 Understand the principles of distributed computing	1.1 discuss the principles, characteristics and features of distributed computing 1.2 critically evaluate the impact of distributed software applications delivered on distributed computing platforms
LO2 Be able to design distributed software applications	2.1 design a distributed software application for a given problem 2.2 explain the components and data and file structures required to implement a given design
LO3 Be able to implement distributed software applications	3.1 implement a distributed software application solution based on a prepared design 3.2 define relationships between components to implement design requirements 3.3 identify and implement opportunities for error handling and reporting 3.4 make effective use of an Integrated Development Environment (IDE) including code and screen templates
LO4 Be able to test distributed software applications	4.1 critically review and test a distributed software application 4.2 analyse actual test results against expected results to identify discrepancies 4.3 evaluate independent feedback on a developed distributed software application and make recommendations for improvements 4.4 create user documentation for the developed distributed software application 4.5 create technical documentation for the support and maintenance of a distributed software application.

## Guidance

### Links to National Occupational Standards, other BTEC units, other BTEC qualifications and other relevant units and qualifications

The learning outcomes associated with this unit are closely linked with:

Level 3	Level 4	Level 5
	Unit 18: Procedural Programming	Unit 39: Computer Games Design Development
	Unit 19: Object Oriented Programming	Unit 40: Distributed Software Applications
	Unit 20: Event Driven Programming Solutions	Unit 41: Programming in Java
	Unit 21: Software Applications Testing	Unit 42: Programming in .NET
	Unit 22: Office Solutions Development	
	Unit 23: Mathematics for Software Development	

This unit has links to the Level 4 and Level 5 National Occupational Standards for IT and Telecoms Professionals, particularly the areas of competence of:

- Software Development.

### Essential requirements

Whilst some programming languages are commercially available, there are also free languages available incorporating an advanced set distributed components deployed on many platforms. You must ensure that in the case of mobile platforms the applicable free emulators are available or where security policies dictate, local work stations are equipped with virtualised operating systems containing the programming environment.

## Resources

### Books

Kshemkalyan A and Singhal M <http://www.amazon.co.uk/Distributed-Computing-Principles-Algorithms-Systems/dp/0521876346/>— *Distributed Computing: Principles, Algorithms, and Systems* (Cambridge University Press, 2008) ISBN-10: 0521876346

Tanenbaum A and van Steen M – *Distributed Systems: Principles and Paradigms* (Pearson Education, 2008) ISBN-10: 0136135536

### Websites

[www.springer.com/computer/communication+networks/journal/446](http://www.springer.com/computer/communication+networks/journal/446)

[www.wisegeek.com/what-is-distributed-computing.htm](http://www.wisegeek.com/what-is-distributed-computing.htm)

## Employer engagement and vocational contexts

Working with a local programming-based organisation or using internet-based open source projects would enhance the learners' experience and offer a relevant vocational context.

## Unit 41: Programming in Java

**Unit code:** F/601/1528

**QCF Level 5:** BTEC Higher National

**Credit value:** 15

### ● Unit aim

To provide learners with an understanding of the principles of programming in Java, exploring the object oriented nature of the language and the multi-platform versatility offered.

### ● Unit abstract

Object oriented programming is an industry-proven method for developing reliable modular programs and is popular in software engineering and systems development. Consistent use of object oriented techniques can lead to shorter development lifecycles, increased productivity, adaptable code, reuse of different technologies, the interaction of different systems using common platforms and therefore lower the cost of producing and maintaining systems.

Java is synonymous with the object orient paradigm offering all the features of the technology in a format that can be used on many differing systems. The development of systems with Java objects simplifies the task of creating and maintaining complex applications.

Many environments use Java as its 'underpinning' framework, with Java applications found on mobile phones, dedicated systems, web-based multimedia, security and control systems as well as traditional applications and bespoke operating systems.

Learners taking this unit will have the opportunity to develop their understanding of the Java programming language and develop code suited to a range of platforms. The unit is not specific to one instance of the Java programming language and may be used to deploy, among others, mobile applications, bespoke applications or web-based solutions.

### ● Learning outcomes

**On successful completion of this unit a learner will:**

- 1 Understand the principles of programming in Java
- 2 Be able to design Java solutions
- 3 Be able to implement Java solutions
- 4 Be able to test and document Java solutions.

## Unit content

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### 1 Understand the principles of programming in Java

*Characteristics:* Java Virtual Machine (JVM); Java platform; classed-based; object-oriented; compilers; class libraries; applications; applets; object models; enforced error handling; concurrency; threads, multi-platform

*Reasons for choice of language:* organisational policy; suitability of features and tools; availability of trained staff; reliability; development and maintenance costs; expandability

*Object models:* inheritance; polymorphism; encapsulation; public classes; private classes; public methods; private methods

*Data structures:* public instance variables; private instance variables; naming conventions; arrays (one-dimensional, two-dimensional); file structures; loops eg conditional (pre-check, post-check, break-points), fixed; conditional statements; case statements; logical operators; assignment statements; input statements; output statements

*Data types:* constants and literals; integer; floating point; byte; date; boolean; others eg character, string, small int; choice of data types eg additional validation, efficiency of storage

*Environment:* features eg interpreted, run time environment, system specific libraries

*Programming syntax:* features eg command rules, variable declaration, class/method declaration

*Standards:* features eg use of comments, code layout, indentation

### 2 Be able to design Java solutions

*Requirements specification:* overview eg inputs, outputs, processing, user interface; constraints eg hardware platforms, timescales for development; delivery environment eg mobile, hand-held, web based, desktop; interaction eg data exchange, compliance, compatibility, standards

*Program design:* tools eg structure diagrams, data flow diagrams, entity relationship models, flow charts, pseudo code, class diagrams, class responsibilities, collaboration cards; inheritance

*Technical documentation:* requirements specification; others as appropriate to language eg form design, flowcharts, pseudo code, structured English, action charts, data dictionary, class and instance diagrams



### 3 Be able to implement Java solutions

*Classes:* features eg identification attributes, methods, control of scope of attributes and methods, inheritance, aggregation, association, polymorphism

*Programming:* use of conventional language commands; use of library classes; pre-defined eg class libraries, downloaded, imported

*Complexity:* multiple classes; inheritance; reuse of objects; application of polymorphism

### 4 Be able to test and document Java solutions

*Mechanisms:* methods eg valid declarations, debugging code, checking naming conventions, checking functionality against requirements, error detection, error messages, compiler errors, runtime errors, in code response, dry running

*Feedback:* record feedback, eg surveys, questionnaire, interviews; analyze feedback; present results

*Supportive documentation:* test plan; test results; programmer guidance; user guidance

*Review:* design against specification requirements, interim reviews

## Learning outcomes and assessment criteria

Learning outcomes  On successful completion of this unit a learner will	Assessment criteria for pass  The learner can
LO1 Understand the principles of programming in Java	1.1 discuss the principles, characteristics and features of programming in Java 1.2 critically evaluate the environmental flexibility of programming in Java
LO2 Be able to design Java solutions	2.1 design a Java programming solution to a given problem 2.2 explain the components and data and file structures required to implement a given design
LO3 Be able to implement Java solutions	3.1 implement a Java programming solution based on a prepared design 3.2 define relationships between objects to implement design requirements 3.3 implement object behaviours using control structures to meet the design algorithms 3.4 identify and implement opportunities for error handling and reporting 3.5 make effective use of an Integrated Development Environment (IDE) including code and screen templates
LO4 Be able to test and document Java solutions	4.1 critically review and test a Java programming solution 4.2 analyse actual test results against expected results to identify discrepancies 4.3 evaluate independent feedback on a developed Java program solution and make recommendations for improvements 4.4 create user documentation for the developed Java program solution 4.5 create technical documentation for the support and maintenance of a Java program solution.

## Guidance

### Links to National Occupational Standards, other BTEC units, other BTEC qualifications and other relevant units and qualifications

The learning outcomes associated with this unit are closely linked with:

Level 3	Level 4	Level 5
Unit 6: Software Design and Development	Unit 18: Procedural Programming	Unit 39: Computer Games Design and Development
Unit 14: Event Driven Programming	Unit 19: Object Oriented Programming	Unit 40: Distributed Software Applications
Unit 15: Object Oriented Programming	Unit 20: Event Driven Programming Solutions	Unit 42: Programming in .NET
Unit 16: Procedural Programming	Unit 21: Software Applications Testing	
	Unit 22: Office Solutions Development	
	Unit 23: Mathematics for Software Development	

This unit has links to the Level 4 and Level 5 National Occupational Standards for IT and Telecoms Professionals, particularly the areas of competence of:

- Software Development.

### Essential requirements

Whilst some procedural languages are commercially available, there are also free languages available incorporating a diverse range of commands, commonly deployed on many platforms. Centres must ensure that in the case of mobile platforms, the applicable free emulators are available.

Learners must have access to facilities, which allow them the opportunity to fully evidence all of the criteria of the unit. If this cannot be guaranteed then centres should not attempt to deliver this unit.

Learners must develop an application that may be event driven, an applet, or command line driven and it may work on a range of platforms. It may be web based, GUI based, a games console or a deliverable for a mobile platform amongst many other solutions.

Centres must use a range of design methodologies, ensuring that the method selected is suited to the environment selected as well as the programming language of choice. Implementation must be based on a suitably structured problem that ensures the use of Java elements. Centres must select a programming activity, or use an external source (employer, commissioner, open source).

## Resources

### Books

Bloch J – *Effective Java, Second Edition* (Prentice Hall, 2008) ISBN: 0321356683

Goetz B – *Java Concurrency in Practice* (Addison Wesley, 2006) ISBN: 0321349601

Niemeyer P – *Learning Java, Third Edition* (O'Reilly, 2005) ISBN: 0596008732

### Websites

<http://java.sun.com/docs/books/tutorial/>

<http://math.hws.edu/javanotes/>

[www.idevelopment.info/data/Programming/java/PROGRAMMING\\_Java\\_Programming.shtml](http://www.idevelopment.info/data/Programming/java/PROGRAMMING_Java_Programming.shtml)

## Employer engagement and vocational contexts

Working with a local programming-based organisation or using internet-based open source projects would enhance the learners' experience and offer a relevant vocational context.

## Unit 42: Programming in .NET

**Unit code:** H/601/1537

**QCF Level 5:** BTEC Higher National

**Credit value:** 15

### ● Aim

To provide learners with an understanding of the principles of programming using a .NET framework as an underpinning technological concept in the fields of programming and systems development.

### ● Unit abstract

The .NET framework defines a range of reusable class libraries that define the interactions used for Windows operating systems based development of utilities, applications, web based resources, games as well as data integration.

Whilst specific to Microsoft products, the .NET framework defines interactions with servers, workstations and mobile devices. The .NET framework also describes interactions and data exchange with other programming and development systems and is designed to enable cross-platform interaction.

This unit allows learners to become familiar with the underpinning concepts of .NET framework programming, without needing to develop particular skills in one chosen language. Each of the languages has the capacity to develop event driven solutions and it is not important which language is chosen as long as the skills being developed and evidenced relate to the key .NET focus.

The focus of the unit is on developing solutions to meet identified user needs while emphasising the importance of testing and reviewing.

### ● Learning outcomes

**On successful completion of this unit a learner will:**

- 1 Understand the principles of programming using a .NET framework.
- 2 Be able to design .NET solutions
- 3 Be able to implement .NET solutions
- 4 Be able to test and document .NET solutions.

## Unit content

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### 1 Understand the principles of programming using a .NET framework

*Version:* current version; backwards compatibility; design considerations; alternative implementations

*Design features:* interoperability, common runtime engine, language independence, base class library, deployment, security, portability

*.NET languages:* eg C#, C++, F#, J#, PowerShell, JScript .NET, IronPython, IronRuby, Visual Basic, IronLISP, L#, P#

*Architecture:* Common Language Infrastructure (CLI), assemblies, metadata, security, class library, memory management; framework versions (architecture) eg 3.5, 3.0, 2.0; common language runtime and the .NET framework class libraries

### 2 Be able to design .NET solutions

*Selection:* identification of .NET compatible programming language, identification of .NET programming libraries, selection of development environment

*Design methodology:* reuse of existing system, adaptation of code, GUI template, graphical interface, design guides, state and interaction diagrams, screen layouts, data storage, event procedures and descriptions

*Specification:* input, output, processes, user need, purpose

*Creation of application:* use of development environment; debugging

*Delivery environment:* mobile, handheld, web based, desktop, dedicated device, server

*Interaction:* exchange of data, compliance, compatibility, recognition of standards employed, environment

### 3 Be able to implement .NET solutions

*Tools and techniques:* use of tool boxes and controls, selection, loops, event handlers, event driven triggers, listeners, objects and object properties, menus, debugging tools

*Data:* variables, data types, declaring variables, scope of variables, constants

*Programming:* use of methods, use of 'traditional coding'

*Complexity:* multiple .NET classes; multiple code elements

#### 4 Be able to test and document .NET solutions

*Mechanisms:* valid declarations; debugging code; comment code; naming conventions; checking functionality against requirements; documentation

*Error handling:* management of extremes, use of system imposed statements, interaction between .NET classes

*Impact testing:* range testing, input testing, load testing, system compatibility

*Feedback:* record feedback, eg surveys, questionnaire, interviews; analyze feedback; present results

*Documentation:* user eg onscreen help to assist users of the programme, pop-ups, help menu, hot-spots; technical eg designs, delivery system, platform, environment, file structures, coding, constraints, documentation for maintenance of programme



## Learning outcomes and assessment criteria

Learning outcomes  On successful completion of this unit a learner will	Assessment criteria for pass  The learner can
LO1 Understand the principles of programming using a .NET framework	1.1 discuss the principles, characteristics and features of programming using a .NET framework 1.2 critically compare different types of .NET framework architectures 1.3 critically evaluate the components that support the .NET framework
LO2 Be able to design .NET solutions	2.1 design a .NET programming solution to a given problem 2.2 explain the components and data and file structures required to implement a given design 2.3 evaluate potential delivery environments and interaction
LO3 Be able to implement .NET solutions	3.1 implement a .NET programming solution based on a prepared design 3.2 implement event handling using control structures to meet the design algorithms 3.3 identify and implement opportunities for error handling and reporting 3.4 make effective use of an Integrated Development Environment (IDE) including code and screen templates
LO4 Be able to test and document .NET solutions	4.1 critically review and test a .NET programming solution 4.2 analyse actual test results against expected results to identify discrepancies 4.3 evaluate independent feedback on a developed .NET program solution and make recommendations for improvements 4.4 create user documentation for the developed .NET program solution 4.5 create technical documentation for the support and maintenance of a .NET program solution.

## Guidance

### Links to National Occupational Standards, other BTEC units, other BTEC qualifications and other relevant units and qualifications

The learning outcomes associated with this unit are closely linked with:

Level 3	Level 4	Level 5
Unit 6: Software Design and Development	Unit 18: Procedural Programming	Unit 39: Computer Games Design and Development
Unit 14: Event Driven Programming	Unit 19: Object Oriented Programming	Unit 40: Distributed Software Applications
Unit 15: Object Oriented Programming	Unit 20: Event Driven Programming Solutions	Unit 41: Programming in Java
Unit 16: Procedural Programming	Unit 21: Software Applications Testing	
	Unit 22: Office Solutions Development	
	Unit 23: Mathematics for Software Development	

This unit has links to the Level 4 and Level 5 National Occupational Standards for IT and Telecoms Professionals, particularly the areas of competence of:

- Software Development.

### Essential requirements

Whilst some event driven languages are commercially available, there are also free languages available incorporating an advanced set of .NET features deployed on many platforms. Centres must ensure that in the case of mobile platforms the applicable emulators are available.

Learners must have access to facilities which allow them the opportunity to fully evidence all of the criteria of the unit. If this cannot be guaranteed then centres should not attempt to deliver this unit.

Learners must develop an application that may be event driven and work on a range of .NET platforms. It may be web based, GUI based, a games console or a deliverable for a mobile platform, amongst many other solutions.

## Resources

### Books

Esposito D – *Programming Microsoft ASP.NET MVC* (Microsoft, 2010) ISBN-10: 0735627142

Libert J, Horovitz A – *Programming .NET 3.5* (O'Reilly, 2008) ISBN-10: 059652756X

Lowy J – *Programming .NET Components: Design and Build .NET Applications Using Component-Oriented Programming* (O'Reilly, 2005) ISBN-10: 0596102070

### Websites

<http://msdn.microsoft.com/en-gb/library/zw4w595w.aspx>

[www.dotnet-guide.com/](http://www.dotnet-guide.com/)

[www.programmingtutorials.com/vbnet.aspx](http://www.programmingtutorials.com/vbnet.aspx)

## Employer engagement and vocational contexts

Working with a local programming-based organisation or using internet-based open source projects would enhance the learners' experience and offer a relevant vocational context.

## Unit 43: Networking Infrastructure

**Unit code:** A/601/1964

**QCF Level 5:** BTEC Higher National

**Credit Value** 15

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- **Aim**

To provide learners with an understanding of networking infrastructures, the directory based system that supports the addressing and resource management of any large scale networked system.

- **Unit abstract**

Network infrastructure systems such as Active Directory (from Microsoft) or eDirectory (from Novell) amongst many others, are systems used to manage resources, naming of devices, allocation of rights, privileges and security policies.

Each can be used to deploy software as well as control the behaviour of the network infrastructure. Learners taking this unit will explore the principles supporting any network infrastructure system, design a solution for a given networked environment as well as implement and test the solution.

This unit has links to many vendor qualifications and can be used to encourage the study and certification of these by learners. Additionally this unit links to all networking and systems support units and offers learners the opportunity to build a complex network system.

- **Learning outcomes**

**On successful completion of this unit a learner will:**

- 1 Understand the principles of network infrastructure management
- 2 Be able to design complex network infrastructure systems
- 3 Be able to implement complex network infrastructure systems
- 4 Be able to test complex network infrastructure systems.

## Unit content

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### 1 Understand the principles of network infrastructure management

*Name resolution:* services eg Domain Name System (DNS), eDirectory, Active Directory; requirements eg addressing, resource management, user management, services management, security of resources, access control

*Technology:* resources eg servers supporting networking infrastructure management, routers, printers, switches, firewalls, clients, wireless access, cabled access, remote workstations, 3G based remote access

*Security:* resources eg rights management, resource availability, user management, access times, group allocation, timed access, encryption, authentication, Virtual Private Network (VPN), tunneling, remote access, RADIUS (Remote Access Dial In Support), TACACS (Terminal Access Controller Access-Control System), IPSec, certificate authorities, PKI (Public Key Infrastructure)

### 2 Be able to design complex network infrastructure systems

*Addressing:* naming methodology, delivery of addresses, identification of devices and resources

*Rights:* designing user and group rights, access rights to resources, access to files, access to printers, access to services

*Security:* creation of remote access services, deployment of VPN access, time based rules, trust management, access control and login, logging, system activity audit trail

*Deployment:* scalable, use of technology, adaptable, change management, commercial requirements, supportive of environment

### 3 Be able to implement complex network infrastructure systems

*Addressing:* application of naming methodology, delivery of addresses

*Rights:* issue of rights to users, apply rights to groups, apply access rights to resources, access to files, access to printers, access to external services

*Security management:* remote access services, deployment of VPN access rules, trust management, access control and login, logging, system activity audit trail

*Interaction:* with external DNS, with other directory services, with existing directory services infrastructure

### 4 Be able to test complex network infrastructure systems

*System assurance:* security of system, access, availability, visibility of all resources

*User assurance:* valid access issued, group access, inheritance of rights

*Documentation:* test plan; test results; analyse results

## Learning outcomes and assessment criteria

Learning outcomes  On successful completion of this unit a learner will:	Assessment criteria for pass  The learner can:
LO1  Understand the principles of network infrastructure management	1.1 evaluate current name resolution services 1.2 discuss the technologies that support network infrastructure management 1.3 discuss security resources available in network infrastructure management
LO2  Be able to design complex network infrastructure systems	2.1 design a network infrastructure for a given networked environment 2.2 evaluate addressing and deployment solutions for a given networked environment 2.3 evaluate rights and security requirements for a given networked environment
LO3  Be able to implement complex network infrastructure systems	3.1 implement a network infrastructure based on a prepared design
LO4  Be able to test complex network infrastructure systems	4.1 critically review and test an implemented system 4.2 evaluate system and user assurance of the implemented system.

## Guidance

### Links to National Occupational Standards, other BTEC units, other BTEC qualifications and other relevant units and qualifications

The learning outcomes associated with this unit are closely linked with:

Level 3	Level 4	Level 5
Unit 5: Managing Networks	Unit 24: Networking Technologies	Unit 44: Local Area Networking Technologies
Unit 9: Computer Networks	Unit 25: Routing Concepts	Unit 45: Wide Area Networking Technologies
Unit 10: Communication Technologies	Unit 26: Design a Small or Home Office Network	Unit 46: Network Security
Unit 32: Networked Systems Security	Unit 27: Network Operating Systems	

This unit has links to the Level 4 and Level 5 National Occupational Standards for IT and Telecoms Professionals, particularly the areas of competence of:

- IT/Technology Infrastructure Design and Planning
- IT/Technology Service Operations and Event Management
- IT/Technology Management and Support
- Change and Release Management.

### Essential requirements

Learners must have access to a live or 'detached' network environment to create the network infrastructure and develop their skills. This may also be successfully accomplished using virtual machines.

Learners must have access to facilities which allow them the opportunity to fully evidence all of the criteria of the unit. If this cannot be guaranteed then centres should not attempt to deliver this unit.

Implementation of the infrastructure solution must be tested systematically and procedurally based on the technology used in the design solution. The solution implemented may be on a live system, but ideally should be tested in a simulated or sand box environment.



## Resources

### Books

Mackin J and McLean I – *MCSE Implementing, Managing & Maintaining a Windows Server 2003 Network Infrastructure* (Microsoft, 2006) ISBN-10: 0735622884

White G et al – *CompTIA Security+ All-in-One Exam Guide, Second Edition* (McGraw Hill, 2009) ISBN-10: 0071601279

### Employer engagement and vocational contexts

Working with a live system will present many risks that the centre, employer and learner must be aware of. Using a current vocational context to deploy an additional or alternate solution will enhance the learners' experience and enable understanding of wider technical application.



## Unit 44: Local Area Networking Technologies

**Unit code:** L/601/1547

**QCF Level 5:** BTEC Higher National

**Credit value:** 15

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- **Aim**

To provide learners with an understanding of Local Area Network (LAN) technologies and the delivery of a wide range of networked services across a LAN infrastructure.

- **Unit abstract**

LANs have become ubiquitous in all but the smallest of enterprises and their implementation has become the realm of skilled designers if the best advantage is to be made of available technology. Whilst it is now the case that simple networks can often be installed by users with little previous knowledge, the design, implementation, testing and management of extended LANs requires considerable technical knowledge.

The impact of LANs across an organisation can require upskilling of staff, changes to the physical environment and changes to commercial procedures. It also requires changes to the access, security and ownership of the data which passes across the LAN. In this unit learners will understand that consideration must be given to not only the physical LAN but the organisational culture as a whole.

Learners will understand the importance of considering both physical and logical environments including network addressing, best use of media, and network segmentation. Learners will also study Quality of Service (QoS) in order to best manage the network traffic. Once a LAN is installed and operational learners will study methods of measuring and maintaining performance in a proactive manner using a range of tools.

- **Learning outcomes**

**On successful completion of this unit a learner will:**

- 1 Understand the impact of LAN technologies
- 2 Be able to design LAN infrastructures
- 3 Be able to implement LAN infrastructures
- 4 Be able to manage LAN infrastructures.

## Unit content

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### 1 Understand the impact of LAN technologies

*LAN technologies:* standards eg IEEE 802 LAN standards, IEEE 802.11 wireless standards, STP (Spanning Tree Protocol), VLANs (Virtual LAN), VTP (VLAN Trunking Protocol), standby routing, ether channel, ISL (Inter Switch Link), DHCP (Dynamic Host Configuration Protocol); LAN hardware: eg layer 2 switches, layer 3 switches, layer 4 switches, wireless devices, network interfaces, client devices

*Traffic intensive services:* quality of service management eg DSCP (Differentiated Service Code Point), IP precedence, queues, base rules, 802.1q frame tagging; quality of service need eg Voice over IP, video streaming, audio streaming;

*LAN security:* security need eg VLANs, switch port control, ACLs (Access Control Lists), MAC-ACL's, MAC (Media Access Control) address filtering, wireless security, port spanning

### 2 Be able to design LAN infrastructures

*Devices:* expected average number and types of devices on system; anticipated participation

*Bandwidth:* expected average load; anticipated peak load; cost constraint

*Users:* quality expectations, concept of system growth

*Applications:* security requirements, quality of service needs, redundancy

*Communications:* suited to devices, suited to users, supportive of quality of service

*Scalable:* able to support device growth, able to support addition of communication devices, able to cope with bandwidth use and trend change

*Security:* device access, VLAN membership, traffic management, system monitoring

*Traffic intensive services:* application of rules, prioritisation

*Technology:* VLAN design, STP design, DHCP address allocation design, wireless infrastructure design

### 3 Be able to implement LAN infrastructures

*Devices:* installation of communication device, allocation of addresses, local client configuration

*Services:* directory, authentication, DNS (Domain Name Service), email, network file, printing

*Specialised configuration:* VLAN, VTP, standby, ether channel, STP

*Security:* ACLs, VLAN membership

*Traffic management:* system monitoring, traffic intensive services, traffic precedence

*Connectivity:* suitable bandwidth, cabling, wireless infrastructure

*Testing:* external access eg WAN access, access to internet; security; bandwidth

#### 4 Be able to manage LAN infrastructures

*LAN performance:* network monitoring tools, user access, traffic analysis, bandwidth monitoring, checking configuration, checking rules

*LAN issues:* using troubleshooting methodology; proving resolution

## Learning outcomes and assessment criteria

Learning outcomes  On successful completion of this unit a learner will:	Assessment criteria for pass  The learner can:
LO1  Understand the impact of LAN technologies	1.1 critically evaluate different LAN technologies 1.2 critically analyse traffic intensive services and their performance 1.3 discuss LAN concerns and make recommendations to sustain network security, reliability and performance
LO2  Be able to design LAN infrastructures	2.1 design a LAN infrastructure to meet a given requirement 2.2 critically evaluate the suitability of LAN components
LO3  Be able to implement LAN infrastructures	3.1 build and configure a LAN (including services) to meet a given requirement 3.2 implement network security on a LAN 3.3 critically review and test a LAN
LO4  Be able to manage LAN infrastructures	4.1 monitor and troubleshoot a LAN 4.2 resolve LAN issues to improve security, reliability and performance 4.3 critically evaluate the performance of a LAN.

## Guidance

### Links to National Occupational Standards, other BTEC units, other BTEC qualifications and other relevant units and qualifications

The learning outcomes associated with this unit are closely linked with:

Level 3	Level 4	Level 5
Unit 5: Managing Networks	Unit 24: Networking Technologies	Unit 45: Wide Area Networking Technologies
Unit 9: Computer Networks	Unit 25: Routing Concepts	Unit 46: Network Security
Unit 10: Communication Technologies	Unit 26: Design a Small or Home Office Network	
Unit 32: Networked Systems Security	Unit 27: Network Operating Systems	

This unit has links to the Level 4 and Level 5 National Occupational Standards for IT and Telecoms Professionals, particularly the areas of competence of:

- IT/Technology Infrastructure Design and Planning
- IT/Technology Service Operations and Event Management
- IT/Technology Management and Support
- Change and Release Management.

### Essential requirements

Learners must have access to a live or 'detached' network environment to create the network infrastructure and develop their skills; this may also be successfully accomplished using virtual machines.

Learners must have access to facilities, which allow them the opportunity to fully evidence all of the criteria of the unit. If this cannot be guaranteed then centres should not attempt to deliver this unit.

Evaluation of current systems and solutions, commercial practices, social conditions and the culture surrounding the system in use is of as much importance as delivering work supporting potential understanding of the technological systems and the services they offer.

Learners must have access to a range of suitable networking hardware (eg hubs, switches, routers) and software (eg operating systems, management and utility software) as it is important to undertake as many practical activities as possible to reinforce theoretical learning. There are many virtual, emulated and simulated systems that now support delivery. If used they must contain the elements pertinent to the core of this qualification unit to assure delivery.



## Resources

### Books

Cisco Networking Academy – *CCNA Exploration Course Booklet: LAN Switching and Wireless, Version 4.0* (Cisco Press, 2009) ISBN-10: 1587132540

Dean T – *CompTIA Network+ 2009 In Depth* (Delmar, 2009) ISBN-10: 1598638785

Xiao Y, Pan Y – *Wireless LANs and Bluetooth* (Nova Science, 2005) ISBN-10: 1594544328

### Websites

[www.cisco.com](http://www.cisco.com)

[www.wb.nic.in/nicnet/lan1.html](http://www.wb.nic.in/nicnet/lan1.html)

## Employer engagement and vocational contexts

Working with a live system will present many risks, that the centre, employer and learner must be aware of. Using a current vocational context to deploy an additional or alternate solution will enhance the learners' experience and enable understanding of wider technical application.

## Unit 45: Wide Area Networking Technologies

**Unit code:** F/601/1562

**QCF Level 5:** BTEC Higher National

**Credit value:** 15

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- **Aim**

To provide learners with an understanding of Wide Area Network (WAN) technologies and the delivery of a wide range of networked services across a WAN infrastructure.

- **Unit abstract**

WANs such as the internet have become a part of everyday life with many commercial, educational and governmental organisations having ownership or access to a WAN infrastructure. Many home and small business users broadband/ADSL (Asymmetric Digital Subscriber Line) connections are part of a WAN infrastructure supplied by their Internet Service Provider, where in many cases, the WAN precedes the direct connection to the internet.

The impact of a WAN across an organisation includes the up-skilling of staff, changes to the physical environment and changes to commercial procedures. It also requires changes to the access, security and ownership of the data which passes across the WAN. In this unit learners will understand that consideration must be given to not only the physical WAN but the organisational culture as a whole.

Learners will understand the importance of considering how WAN devices communicate and 'learn' about other devices and the changing topology. They will also explore communication speed and traffic management issues relating to the Quality of Service (QoS) of data delivery.

- **Learning outcomes**

**On successful completion of this unit a learner will:**

- 1 Understand the impact of WAN technologies
- 2 Be able to design WAN infrastructures
- 3 Be able to implement WAN infrastructures
- 4 Be able to manage WAN infrastructures.

## Unit content

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### 1 Understand the impact of WAN technologies

*WAN technologies:* eg dial-up, ADSL (Asymmetric Digital Subscriber Line) and all derivatives, broadband, frame relay, ISDN (Integrated Services Digital Network), MPLS (Multiprotocol Layer Switching), interior routing protocols, exterior routing, static routing; WAN hardware: eg routers, layer 2 aggregators, servers, cabling systems, modems, transceivers, satellite uplinks, 3G, 4G, VPN concentrators

*Traffic intensive services:* quality of service management eg DSCP (Differentiated Service Code Point), IP precedence, queues, base rules, congestion management; quality of service need eg Voice over IP, video streaming, audio streaming;

*WAN security:* eg MD5 hash (Message Digest algorithm 5), broadcast reduction, filters, traffic rules, firewalls, access control lists, directed updates, tunnelling

*Trust:* trust of intermediary system; trust of remote systems; trust of networks on WAN

### 2 Be able to design WAN infrastructures

*Devices:* expected average number of devices on system; anticipated participation

*Bandwidth:* expected average load; anticipated peak load; cost constraint

*Users:* quality expectations, concept of system growth

*Applications:* security requirements, quality of service needs, redundancy

*Communications:* suited to devices, suited to users, supportive of quality of service

*Scalable:* eg able to support network growth, able to support addition of communication devices, able to cope with bandwidth use and trend change

*Security:* network access, protocol management, peer authentication, tunneling across untrusted domains

*Technology:* network design, routing table reduction, protocol management

### 3 Be able to implement WAN infrastructures

*Devices:* eg installation of communication devices allocation of networks, communication device configuration

*Services:* DNS (Domain Name Service), email, web, video, application

*Specialised configuration:* eg routing protocol, interfaces, network address allocation, security features, security ACLs, MD5 authentication, tunnel creation

*Traffic management:* system monitoring, traffic intensive, traffic precedence

*Connectivity:* suitable bandwidth, communication infrastructure, throughput

*Testing:* local systems able to inter-communication; security; bandwidth

#### 4 Be able to manage WAN infrastructures

*WAN performance:* network monitoring tools, user access, traffic analysis, bandwidth monitoring, checking configuration, checking rules

*Resolve WAN issues:* using troubleshooting methodology; prove resolution

## Learning outcomes and assessment criteria

Learning outcomes On successful completion of this unit a learner will:	Assessment criteria for pass The learner can:
LO1 Understand the impact of WAN technologies	1.1 critically evaluate different WAN technologies 1.2 critically analyse traffic intensive services and their performance 1.3 discuss WAN concerns and make recommendations to sustain network security, reliability and performance 1.4 critically evaluate different trust systems on a WAN
LO2 Be able to design WAN infrastructures	2.1 design a WAN infrastructure to meet a given requirement 2.2 critically evaluate the suitability of WAN components
LO3 Be able to implement WAN infrastructures	3.1 build and configure a WAN (including services) to meet a given requirement 3.2 implement network security on a WAN 3.3 critically review and test a WAN
LO4 Be able to manage WAN infrastructures	4.1 monitor and troubleshoot a WAN 4.2 resolve WAN issues to improve security, reliability and performance 4.3 critically evaluate the performance of a WAN.

## Guidance

### Links to National Occupational Standards, other BTEC units, other BTEC qualifications and other relevant units and qualifications

The learning outcomes associated with this unit are closely linked with:

Level 3	Level 4	Level 5
Unit 5: Managing Networks	Unit 24: Networking Technologies	Unit 44: Local Area Networking Technologies
Unit 9: Computer Networks	Unit 25: Routing Concepts	Unit 46: Network Security
Unit 10: Communication Technologies	Unit 26: Design a Small or Home Office Network	
Unit 32: Networked Systems Security	Unit 27: Network Operating Systems	

This unit has links to the Level 4 and Level 5 National Occupational Standards for IT and Telecoms Professionals, particularly the areas of competence of:

- IT/Technology Infrastructure Design and Planning
- IT/Technology Service Operations and Event Management
- IT/Technology Management and Support
- Change and Release Management.

### Essential requirements

Learners must have access to a live or 'detached' network environment to create the network infrastructure and develop their skills. This may also be successfully accomplished using virtual machines.

Learners must have access to facilities, which allow them the opportunity to fully evidence all of the criteria of the unit. If this cannot be guaranteed then centres should not attempt to deliver this unit.

Evaluation of a current systems and solutions, commercial practices, social conditions and the culture surrounding the system in use is of as much importance as delivering work supporting potential understanding of the technological systems the and the services they offer.

Learners must have access to a range of suitable networking hardware and as it is important to undertake as many practical activities as possible to reinforce theoretical learning. There are many virtual, emulated and simulated systems that now support delivery; they must contain the elements pertinent to the core of this qualification unit to assure delivery.

## Resources

### Books

Reid A – *WAN Technologies CCNA 4 Companion Guide* (Cisco Press, 2006) ISBN-10: 1587131722

### Websites

<http://www.networktutorials.info/>

## Employer engagement and vocational contexts

Working with a live system will present many risks, that the centre, employer and learner must be aware of. Using a current vocational context to deploy an additional or alternate solution will enhance the learners' experience and enable understanding of wider technical application.



## Unit 46: Network Security

**Unit code:** D/601/1956

**QCF Level 5:** BTEC Higher National

**Credit value:** 15

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### ● Aim

To provide learners with opportunities to manage, support and implement a secure network infrastructure for a commercial LAN or WAN environment.

### ● Unit abstract

ICT professionals managing a complex network infrastructure for a large corporate entity, as well as individuals maintaining small systems or personal access, all have to contemplate and implement a variety of network security intrusion prevention and detection methods.

Attacks evolve and threats change as systems increase in speed, capacity and use and as technologies change. The network security expert needs to ensure their skills remain current and maintain an understanding of the technological issues along with the social and commercial impact.

This unit explores the social impact of network security, and by designing a network security solution learners will understand the importance of enabling the IT user to remain safe whilst being able to use the system without unreasonable restrictions.

Learners will research, design and implement secure environments protecting IT systems and therefore individuals from attack. The protection will include intrusion detection and prevention, user and resource access management and the maintenance of malware defence. Learners will implement a proposed networked security solution, and manage the implemented solution.

### ● Learning outcomes

**On successful completion of this unit a learner will:**

- 1 Understand the impact on the social and commercial environment of network security design
- 2 Be able to design network security solutions
- 3 Be able to implement network security solutions
- 4 Be able to manage network security solutions.

## Unit content

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### 1 Understand the impact on the social and commercial environment of network security design

*Threats:* management of threats eg awareness, current threats, patches, updates, access policies, maintenance of systems, expertise management

*Social impact:* organisation trust eg data credibility, good will, corporate trust, financial trust; individual impact; corporate impact; social engineering; public relations management; law enforcement involvement

*Security policy:* review and management eg access to systems, establishment and review of personal, corporate and technical trust; vetting of staff; forensic analysis of systems

*Impact on productivity:* loss eg systems recovery, data recovery, loss of good will, loss of custom, loss of services; systemic review; legal proceedings

*Estimating risk:* penetration testing; audits eg internal and external; procedures eg establishment of baseline operating model, contingency planning, scrutiny and due diligence, vetting of contractors and commercial partners

### 2 Be able to design network security solutions

*LAN design:* technical response eg STP (Spanning Tree Protocol) prioritisation, MAC control, VLAN (Virtual Local Area Network) security, ARP (Address Resolution Protocol) poisoning, client access, wireless, device trust; VLAN design; trunk design; segregation of LAN segments

*WAN design:* technical response eg routing protocol authentication, access control lists, route maps, passive interfaces, traffic filters, network segregation, DMZ (Demilitarised Zone) management

*Server deployment:* security needs according to server specification eg printer access, file management, data management, email

*Border systems:* Intrusion Detection Systems (IDS) eg firewalls filters and rules, email monitoring, application and packet monitoring, signature management, trust, network behavioural norms; access control eg traffic filters, route redirection

*User access:* user group eg group membership, user group allocation, attribution of rights; user eg personal attribution of rights, continual review of rights allocation; rights eg file, server, service, data, hardware, printer, email

*Physical security:* power resilience and supply; physical access control eg lock and key, electronic access control, personnel based security, biometrics; hardware and systems redundancy; backup eg data, configuration, imaging; recovery policies

### 3 Be able to implement network security solutions

*Core systems:* components eg servers, switch systems, router systems, firewalls

*Communication:* methods eg routing protocols, STP, hash exchanges, VLANs, dot1q

*Cryptography:* tunnelling eg GRE, VPN; key exchange methodology; crypto method eg RSA, IPSec, ISAKMP, IKE, DES, 3DES

*Intrusion detection:* precautions eg establishment of signatures, establish network behavioural norms

*Intrusion prevention:* tools eg firewalls, access control, traffic filters

*Malware:* policy levels eg desktop, server, router; virus definition deployments

*Rights:* access eg user, group, network, device, VLAN, address range, file, database, time based

*Testing:* systematic; type eg port, address, protocol, load, access, known exploits

### 4 Be able to manage network security solutions

*User access:* physical access; systems access

*Environment testing:* security audits; penetration testing

*Policy review:* access policy review; periodic review of user access (physical and system level)

*System monitoring:* monitoring eg load, traffic types, peak flow, trend analysis, user access patterns, device behaviour, logging servers

*Change management:* infrastructure eg network device removal/addition, server addition/removal, network addition/removal; procedural eg user group addition/removal, service addition/removal; impact on productivity

## Learning outcomes and assessment criteria

Learning outcomes On successful completion of this unit a learner will:	Assessment criteria for pass The learner can:
LO1 Understand the impact on the social and commercial environment of network security design	1.1 evaluate a current system's network security 1.2 discuss the potential impact of a proposed network design 1.3 discuss current and common threats and their impact
LO2 Be able to design network security solutions	2.1 design a network security solution to meet a given specification 2.2 evaluate design and analyse feedback
LO3 Be able to implement network security solutions	3.1 using a design, implement a complex network security solution 3.2 systematically test the complex network security solution 3.3 document and analyse test results
LO4 Be able to manage network security solutions	4.1 manage a network security solution 4.2 analyse ongoing network security policies and practices 4.3 recommend potential change management.

## Guidance

### Links to National Occupational Standards, other BTEC units, other BTEC qualifications and other relevant units and qualifications

The learning outcomes associated with this unit are closely linked with:

Level 3	Level 4	Level 5
Unit 32: Networked Systems Security	Unit 24: Networking Technologies	Unit 44: Local Area Networking Technologies
	Unit 25: Routing Concepts	Unit 45: Wide Area Networking Technologies
	Unit 26: Design a Small or Home Office Network	Unit 48: IT Security Management
	Unit 27: Network Operating Systems	

This unit has links to the Level 4 and Level 5 National Occupational Standards for IT and Telecoms Professionals, particularly the areas of competence of:

- IT Security Management.

### Essential requirements

A centre delivering this unit must have access to suitable network routing or switch technology as a live or emulated resource. The primary focus is practice based and therefore this unit cannot be delivered in a theoretical context.

### Resources

#### Books

Bhaiji Y – *Network Security Technologies and Solutions: CCIE Professional Development* (Cisco Press, 2008) ISBN-10: 1587052466

Clem A – *Network Management Fundamentals* (Cisco Press, 2006) ISBN-10: 1587201372

Stallings W – *Network Security Essentials: Applications and Standards* (Pearson, 2008) ISBN-10: 0132303787

White G et al – *CompTIA Security+ All-in-One Exam Guide, Second Edition* (McGraw Hill, 2009) ISBN-10: 0071601279

**Websites**

[www.developers.net/ciscoshowcase/view/1162](http://www.developers.net/ciscoshowcase/view/1162)

[www.eogogics.com/talkgogics/tutorials/SNMP/](http://www.eogogics.com/talkgogics/tutorials/SNMP/)

[www.networktutorials.info/wireless\\_sec.html](http://www.networktutorials.info/wireless_sec.html)

**Employer engagement and vocational contexts**

Liaison with network (or internet) security experts from local or national organisations would enhance the delivery of this unit. If the learner is employed, a contextual assessment based on their working environment with the support of their supervisory management would be of considerable value. Care must be taken to ensure any real work projects are not detrimental to their employer or employment.

## Unit 47: IT Virtualisation

**Unit code:** A/601/1933

**QCF Level 5:** BTEC Higher National

**Credit value:** 15

### ● Aim

To provide learners with an understanding of the principles of virtualisation and the deployment of virtual server and desktop environments as a commercial or personal technology option.

### ● Unit abstract

As technology has evolved, the need to create virtual systems to simulate the behaviour of a real environment has become a primary objective. In having a virtual environment, an information technology professional may use virtualisation to plan a server deployment, test an application or operating system update, as well as test software created in a development environment.

The power of virtualisation has reached a stage where many commercial environments use virtualisation to run seemingly live arrays of servers to ensure redundancy, reliability, security and a lower cost of hardware ownership. It has become possible with the development of server virtualisation environments to have one hardware platform deliver many servers or remote workstations.

There are many hardware and software virtualisation solutions offered by different vendors. This unit allows the learner to access either desktop based virtualisation or server-based virtualisation, or possibly both. In delivery, there are many free to education as well as commercially available offerings.

Creating a virtualisation environment will require an understanding of the host system and its limitations as well as the requirements of the guest operating system. This unit will encourage the learner to explore how this may be accomplished and implement a viable system for commercial or personal use.

### ● Learning outcomes

**On successful completion of this unit a learner will:**

- 1 Understand the commercial impact and potential of virtualisation
- 2 Be able to design virtualisation deployments
- 3 Be able to implement virtualisation deployments
- 4 Be able to manage virtualisation environments.



## Unit content

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### 1 Understand the commercial impact and potential of virtualisation

*Scalability:* methods eg simplicity of server addition, rapid deployment, rapid development

*Redundancy:* methods eg mirroring, server image backup, load balancing, reduction of points of failure

*Support:* centralisation of services, testing of resources

*Environmental:* server deployment; remote desktop; desktop; web based

*Solutions:* server based eg VMWare ESXi, ESX, Citrix; desktop based eg parallels, QEMU, virtual PC, VM-Ware Player, VMWare fusion

*Technology:* hypervisor; abstraction; virtual drivers; network connection eg NAT, bridged; environments for developers; arrays of servers; cloud computing; server solutions; web servers

*Cost:* reduction of hardware cost of ownership; reduction of upgrade costs; larger platforms for many servers

### 2 Be able to design virtualisation deployments

*Needs analysis:* user requirement; corporate requirement; processor load assessment; storage; guest operating system requirement; host operating system requirement; solution needs eg application, development, testing, sandbox, interactivity

*Hardware requirements:* compatibility; storage availability; memory allocation eg host system, guest system, number of instances in use; processor capability; network bandwidth

*Selection of virtualisation solution:* eg server based, desktop based, free, commercial

*Deployment image requirement:* memory required for efficient operation; software eg applications to be installed, updates to be installed, antivirus; addressing eg conformance with host environment; operating system selection eg local need, application requirement

*Environmental:* interaction eg network addressing, access to local storage, access to remote storage, user allocation, membership of directory services

### 3 Be able to implement virtualisation deployments

*Implementation:* tasks eg testing of updates, desktop users, alternate operating systems, sandbox

*Virtualisation environment:* installation eg hardware, environment software, registration of environment with host operating system, addressing of environment with network

*Image environment creation:* establishment of virtual storage requirements eg size, dynamic, fixed; establishment of base memory requirements; network communication; location of image

*Image:* installation eg from ISO, from remote image, pre-existing image, web install

*Image adaptation:* installation of updates; task specific software eg antivirus, applications, development environments

*Testing:* tasks eg producing documentation, system compatibility, hardware and software systems

### 4 Be able to manage virtualisation environments

*User access:* setting of virtual image privilege levels eg user, administrator, read rights, write rights, execution rights

*Environment:* testing eg access, usability, performance, compatibility

*System:* monitoring eg performance; memory use; speed; network access times; load and degradation on host environment

*Update:* maintain image; installation/removal of features; virtual disk management

## Learning outcomes and assessment criteria

Learning outcomes  On successful completion of this unit a learner will:	Assessment criteria for pass  The learner can:
LO1 Understand the commercial impact and potential of virtualisation	1.1 evaluate current virtualisation solutions 1.2 discuss the potential benefits of virtualisation 1.3 discuss the current technology requirements for implementing virtualisation
LO2 Be able to design virtualisation deployments	2.1 complete a needs analysis for a virtualisation deployment 2.2 design a virtualisation solution for a given virtualisation deployment
LO3 Be able to implement virtualisation deployments	3.1 maintain a virtualisation solution 3.2 systematically test the virtualisation environment 3.3 document and analyse test results
LO4 Be able to manage virtualisation environments	4.1 monitor the virtualisation environment 4.2 maintain a virtualisation environment 4.3 critically review and analyse findings.

## Guidance

### Links to National Occupational Standards, other BTEC units, other BTEC qualifications and other relevant units and qualifications

The learning outcomes associated with this unit are closely linked with:

Level 3	Level 4	Level 5
	Unit 2: Computer Systems	Unit 48: IT Security Management
		Unit 49: Digital Forensics

This unit has links to the Level 4 and Level 5 National Occupational Standards for IT and Telecoms Professionals, particularly the areas of competence of:

- Disaster Recovery
- Availability Management.

### Essential requirements

As recommended in the delivery guidance, a centre delivering this unit must have access to suitable virtualisation resources to deliver this unit. There are many free and open source desktop and server solutions and there is no perceived limitation on any centre. The primary focus is practice based and therefore this unit cannot be delivered in a theoretical context.

Learners must have access to facilities, which allow them the opportunity to fully evidence all of the criteria of the unit. If this cannot be guaranteed then centres should not attempt to deliver this unit.

The learner will need to create a virtualisation environment. For server based solutions, this must be on a hardware system capable of supporting a system such as VM Ware ESXi or any other equivalent. For desktop based solutions, the underlying host operating system must have sufficient memory and storage resources to support one or more images in residence.

There are many potential virtualisation solution and implementation approaches, all having different complexities and technological needs as well as outcomes.

If the centre is using a real environment in which to host the virtualisation solution, the legal implications of how this may affect the owners of the real network, as well as the implications for the learner and the academic centre, must be considered.

Implementation of the virtualisation environment must be tested systematically and procedurally based on the technology used in the design solution. The final solution implemented may be on a live system, but ideally should be tested in a segregated 'sandbox' environment.

## Resources

### Books

Ruest N and Ruest D – *Virtualization, A Beginner's Guide* (McGraw Hill, 2009) ISBN-10: 007161401X

Hess K and Newman A – *Practical Virtualization Solutions: Virtualization from the Trenches* (Prentice Hall, 2009) ISBN-10: 0137142978

Lowe S – *Mastering VMware VSphere 4* (Wiley, 2009) ISBN-10: 0470481382

Hoopes J – *Virtualization for Security: Including Sandboxing, Disaster Recovery, High Availability, Forensic Analysis, and Honeypotting* (Syngress, 2009) ISBN-10: 1597493058

### Websites

[www.networkworld.com/links/Research/Storage/Virtualization/index.html](http://www.networkworld.com/links/Research/Storage/Virtualization/index.html)

[www.serverwatch.com/tutorials/article.php/3634911/The-Hows-and-Whys-of-Server-Virtualization.htm](http://www.serverwatch.com/tutorials/article.php/3634911/The-Hows-and-Whys-of-Server-Virtualization.htm)

## Employer engagement and vocational contexts

Liaison with virtualisation and server deployment/management from local or national organisations would enhance the delivery of this unit. If the learner is employed, a contextual assessment based on their working environment with the support of their supervisory management would be of considerable value. Care must be taken to ensure any real work projects are not detrimental to their employer or employment.

## Unit 48: IT Security Management

**Unit code:** A/601/1995

**QCF Level 5:** BTEC Higher National

**Credit value:** 15

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### ● Aim

The aim of this unit is to provide an understanding of IT security management to enable learners to manage organisational security.

### ● Unit abstract

This unit deals with the management of an organisation's security. This involves controlling access, regulating use, implementing contingency plans and devising security policies and procedures. Breaches in security may be caused by human actions, accidental, malicious or negligent, or through incorrect installation, configuration or operation.

Physical security management involves regulating the access to the computers, network devices, databases etc by physical means such as securing buildings from unauthorised access, prevention of loss or damage due to weather, fire and water ingress. Consideration must also be given to alternative sources of supply of hardware, software, power, telecommunications and suitable buildings to allow the organisation to continue after a disaster has occurred (disaster recovery planning).

Human resource management is also an important topic as regards the management of security. It allows for the selection of roles and responsibilities and the associated documentation of organisational procedures based on current legislation and standards.

### ● Learning outcomes

**On successful completion of this unit a learner will:**

- 1 Understand risks to IT security
- 2 Understand mechanisms to control organisational IT security
- 3 Be able to manage organisational security.

## Unit content

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### 1 Understand risks to IT security

*Risks:* types eg unauthorised use of a system without damage to data, unauthorised removal or copying of data or code from a system, damage to or destruction of physical system assets and environment, damage to or destruction of data or code inside or outside the system, naturally occurring risks

*Organisational security:* procedures eg data, network, systems, operational impact of security breaches, web systems, wireless systems

### 2 Understand mechanisms to control organisational IT security

*Risk assessment:* potential loss eg data, intellectual property, hardware and software; probability of occurrence eg disaster, theft; staff responsibilities

*Data protection:* government regulations eg Data Protection Act 1998, Computer Misuse Act ; company regulations: eg site or system access criteria for personnel; anti-virus software; firewalls, basic encryption techniques; operational continuity planning; back-up procedures

*Physical security:* types eg biometrics, swipe cards, theft prevention

### 3 Be able to manage organisational security

*Organisational security:* policies eg system access, access to internet email, access to internet browser, development/use of software, physical access and protection, 3rd party access, business continuity, responsibility; controlling security risk assessments and compliance with security procedures and standards eg ISO/IEC 17799:2005 Information Technology (Security Techniques – code of practice for information security management); informing colleagues of their security responsibilities and confirming their understanding at suitable intervals

*Security:* tools eg user logon profiles to limit user access to resources, online software to train and update staff, auditing tools to monitor resource access

*Security audits:* gathering and recording information on security; initiating suitable actions to deal with identified breaches of security (see also *Human resource issues* below); scheduling of security audits; defining requirements for security audits

*Human resource issues:* staff rights and responsibilities; coping with disaffected staff eg disciplinary procedures in the event of identified security breaches



## Learning outcomes and assessment criteria

Learning outcomes  On successful completion of this unit a learner will:	Assessment criteria for pass  The learner can:
LO1 Understand risks to IT security	1.1 identify and evaluate types of security risks to organisations 1.2 evaluate organisational security procedures
LO2 Understand mechanisms to control organisational IT security	2.1 discuss risk assessment procedures 2.2 evaluate data protection processes and regulations as applicable to an organisation 2.3 analyse physical security issues for an organisation
LO3 Be able to manage organisational security	3.1 design and implement a security policy for an organisation 3.2 evaluate the suitability of the tools used in an organisational policy 3.3 discuss the human resource issues that have to be considered when carrying out security audits.

## Guidance

### Links to National Occupational Standards, other BTEC units, other BTEC qualifications and other relevant units and qualifications

The learning outcomes associated with this unit are closely linked with:

Level 3	Level 4	Level 5
Unit 7: Organisational Systems Security		Unit 36: Internet Server Management
		Unit 46: Network Security
		Unit 47: IT Virtualisation

This unit has links to the Level 4 and Level 5 National Occupational Standards for IT and Telecoms Professionals, particularly the areas of competence of:

- Information Management
- IT Security Management
- Disaster Recovery.

### Essential requirements

IT security has become a subject in its own right and deserves serious consideration in any organisation that uses modern information systems. In order to effectively complete this unit the learner must have access to many sources of information that will allow a natural progression of study from an initial understanding of the risks to organisational security, to an understanding of the mechanisms of control through to designing of policies and procedures.

Whilst this is mainly a managerial/administrative unit, not overly concerned with technical detail of particular computer systems, an understanding of them will be important, especially those that concern access to computer networks, web and wireless access and databases.

### Resources

#### Books

Alexander D et al – *Information Security Management Principles* (BCS, 2008) ISBN-13: 978-1902505909

Beekman G – *Computer Confluence Complete: and Student CD* (Prentice Hall, 2005) ISBN 1405835796

Tipton H – *Information Security Management Handbook: v. 4* (Auerbach Pubs, 2010) ISBN-10: 1439819025

**Websites**

[www.acm.org](http://www.acm.org) – Association of Computing Machinery

[www.bcs.org](http://www.bcs.org) – British Computer Society

[www.bsa.org.uk](http://www.bsa.org.uk) – Business Software Alliance

[www.fast.org.uk](http://www.fast.org.uk) – Federation Against Software Theft

[www.ico.gov.uk](http://www.ico.gov.uk) – Information Commissioners Office

**Employer engagement and vocational contexts**

Liaison with network (or internet) security experts from local or national organisations would enhance the delivery of this unit. If the learner is employed, a contextual assessment based on their working environment with the support of their supervisory management would be of considerable value. Care must be taken to ensure any real work projects are not detrimental to their employer or employment.



## Unit 49: Digital Forensics

**Unit code:** D/601/1939

**QCF Level 5:** BTEC Higher National

**Credit value:** 15

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### ● Aim

To provide learners with an understanding of the principles of digital forensics and the impact on commerce, society and the individual.

### ● Unit abstract

With the evolution of information technology and the increasing adoption of telecommunication-based systems, opportunities for criminal and illegal practice have expanded exponentially. For an ICT professional, managing the security of any complex corporate system comes with many challenges. When a breach of the system occurs a criminal act takes place against an organisation or an individual.

As with a real-world crime scene, a computer system can be used as a tool to implicate criminal activity. The need to preserve the crime scene and ensure the analysis is completed in a manner conducive to the fair and unbiased pursuit of justice is of the greatest importance.

In legal proceedings, the evidence presented is often called into doubt by the presence of unsafe practice in the acquisition of forensic evidence from a computer system. In taking this unit, the learner is introduced to IT forensics and the critical need for accurate, detailed and recorded investigation of the fact.

The practice of IT forensics has to be supported by individuals trained in national or international law enforcement practice. In preserving the scene learners must ensure system logs, operating system data and other relevant information is acquired and stored as an image of the time of forensic acquisition. Learners must be in a position to assist any potential legal process and ensure the evidence acquired supports a successful and fair legal outcome.

Learners will need to understand and review cases where the process of forensic analysis determines the absence of direct criminal intent and serves as a process to improve security and administrative processes as well as technological implementation.

### ● Learning outcomes

**On successful completion of this unit a learner will:**

- 1 Understand the impact of digital forensics on the social and commercial environments
- 2 Understand the principles of evidence gathering
- 3 Be able to plan and implement digital forensics investigations
- 4 Be able to analyse the outcomes of digital forensics investigations.

## Unit content

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### 1 Understand the impact of digital forensics on the social and commercial environments

*Approach:* types eg legal forensic analysis, illegal forensic analysis, defensive forensics, offensive forensics

*Data manipulation:* digital data/information hiding techniques eg steganography, encryption, obfuscation; tools available

*Malware:* types eg virus, trojan, worm, zombie, botnet, keylogger, screen recorder; social engineering; exploitation of personal confidence

*Motivation:* deliberate eg commercial, criminal, personal, political, ideological, investigative; casual eg explorative, leading to deliberate motivation

*Commercial:* impacts eg loss of faith, financial loss, competitive advantage, unfavourable corporate image

*Social:* impacts eg financial loss, loss of resource, loss of access, loss of trust

### 2 Understand the principles of evidence gathering

*Evidence:* chain of custody; evidence preservation; local legislation on evidence; international evidence requirements; jurisdiction

*Evidential challenges:* technological change; technological behaviours; adaptability of the opponent; change in legislative practice; legal challenge

*Involvement of legal authorities:* international law enforcement; local law enforcement; criminal proceedings; civil action

*Record keeping:* methods eg reporting, recording, statements, system logs, operating system images

*Interview of witnesses:* methods eg keeping a record, with a co-interviewer, interviewees right to counsel; involvement of corporate personnel management eg disciplinary management, criminal proceedings, civil action; background checks

### 3 Be able to plan and implement digital forensics investigations

*Network forensics*: sources eg traffic monitoring, traffic signatures, Simple Mail Transfer Protocol (SMTP) logging, span ports, traffic redirection, traffic reassembly, intrusion detection systems, email trails, firewall logs, anomaly identification and management, scanning tools, Address Resolution Protocol (ARP) poisoning

*Workstation or server forensics*: sources eg analysis of file systems, different operating system profiles, malware detection and removal, working on images of systems, application MD5 fingerprint, registry (system database) change analysis

*Data Forensics*: sources eg storage device data recovery, analysis of data change, database rollback and audit

*Device specific behaviour*: devices eg server, desktop computer, mobile device, file system, communication medium, protocol, application used, power status

*Tools*: commercial eg encase, fdk, helix, cloning software, virtualisation environments, virus scanning, network scanning, network analysis; open source; system logs; access logs

*Planning*: evidence gathering techniques; involvement of legal authority; involvement of corporate personnel management; record keeping; time constraint; diligence

*Safe practice*: procedures eg handling evidence on first receipt, creation of images, disk cloning, safe shutdown of an active system for forensic analysis.

### 4 Be able to analyse the outcomes of digital forensics investigations

*Presentation of the fact*: impartial information; absence of supposition; detailed delivery; independent analysis eg second opinion

*Reporting*: legal proceedings (civil, criminal, disciplinary, technical review, security audit, procedural audit)

*Procedural change*: update policy eg security, technology, forensic analysis technique, staff vetting



## Learning outcomes and assessment criteria

Learning outcomes  On successful completion of this unit a learner will:	Assessment criteria for pass  The learner can:
LO1 Understand the impact of digital forensics on the social and commercial environments	1.1 evaluate current forensic practice 1.2 discuss the potential impact of a forensic investigation 1.3 discuss the impact of 'motivation', data manipulation and malware
LO2 Understand the principles of evidence gathering	2.1 discuss the principles of evidence gathering 2.2 evaluate current evidence gathering practices and assess their impact
LO3 Be able to plan and implement digital forensics investigations	3.1 based on a given scenario, plan a digital forensics investigation 3.2 implement a digital forensics investigation 3.3 systematically record each process during investigation
LO4 Be able to analyse the outcomes of digital forensics investigations	4.1 present findings of forensics investigation 4.2 critically review and analyse findings.

## Guidance

### Links to National Occupational Standards, other BTEC units, other BTEC qualifications and other relevant units and qualifications

The learning outcomes associated with this unit are closely linked with:

Level 3	Level 4	Level 5
		Unit 46: Network Security
		Unit 48: IT Security Management

This unit has links to the Level 4 and Level 5 National Occupational Standards for IT and Telecoms Professionals, particularly the areas of competence of:

- IT Security Management.

### Essential requirements

As recommended in the delivery guidance, a centre delivering this unit must have access to suitable forensic applications and 'investigative' artefacts to deliver this unit. The primary focus is practice based and therefore this unit cannot be delivered in a theoretical context.

Learners must have access to facilities which allow them the opportunity to fully evidence all of the criteria of the unit. If this cannot be guaranteed then centres should not attempt to deliver this unit.

The learner will need to evaluate a system, using an existing system or live computer.

The investigation must be systematic and procedural based on the planning and current 'local' forensic practice. Please refer to local law, international law and the accepted practice of managing criminal evidence.

### Resources

#### Books

Casey E – *Handbook of Digital Forensics and Investigation* (Academic Press, 2009) ISBN-10: 0123742676

Carvey H – *Windows Forensic Analysis DVD Toolkit* (Syngress, 2009) ISBN-10: 1597494224

Malin C et al – *Malware Forensics: Investigating and Analyzing Malicious Code* (Syngress, 2009) ISBN-10: 159749268X

**Websites**

[www.digitalforensicsmagazine.com/](http://www.digitalforensicsmagazine.com/)

[www.e-evidence.info/thiefs\\_page.html](http://www.e-evidence.info/thiefs_page.html)

**Employer engagement and vocational contexts**

Liaison with local or national law enforcement would enhance the delivery of this unit. If the learner is employed, a contextual assessment based on their working environment with the support of their supervisory management would be of considerable value. Extreme care must be taken to ensure any real work projects are not detrimental to their employer or employment, or prejudicial to any potential legal outcome.

## Unit 50: Work-based Experience

**Unit code:** D/601/0998

**QCF level 5:** BTEC Higher Nationals

**Credit value:** 15

### ● Aim

This unit aims to enable learners to experience the scope and depth of learning which may take place in a work-based context by planning, monitoring and evaluating the work experience.

### ● Unit abstract

A significant amount of learning can be achieved by carrying out practical activities in a workplace. Learning may be enhanced by taking a more formal approach to work-based activities – by planning, carrying out the activities and reflecting on the benefits of the activities to the business and to the learner.

This unit is designed to allow flexibility of study for part-time and full-time learners. It is expected that learners will be supervised in the workplace in addition to the supervision provided by their academic supervisor.

Learners will have the opportunity, supported by their supervisors, to negotiate and perform activities which will allow them to fulfil the assessment criteria for this unit. They will recognise the scope of what they have achieved by recording evidence from carrying out the activities. They will also gain maximum benefit by reflection on and evaluation of the work they undertake.

### ● Learning outcomes

**On successful completion of this unit a learner will:**

- 1 Be able to negotiate industry experience
- 2 Understand the specific requirements of the placement
- 3 Be able to undertake work experience as identified
- 4 Be able to monitor and evaluate own performance and learning.

## Unit content

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### 1 Be able to negotiate industry experience

*Suitable organisation and location:* types of establishments for placement eg industry-related work for a client brief at college, existing work environment, different departments within current employer's business

*Negotiation:* methods of contacting organisations; methods of undertaking negotiations

*Nature of duties:* type of undertaking eg routine duties and tasks, project work, development of new procedures/protocol

*Supervisors:* roles and responsibilities of academic and industrial mentors

*Expectations of learning:* aims eg proficiency in new tasks and procedures, time-management and problem-solving skills, reflection, discuss progress with others, teamwork

*Business constraints:* consideration of possible limitations eg need to be fully trained, adherence to quality systems, health and safety considerations, supervision time, workload, customer satisfaction, limited staffing, cost of materials

### 2 Understand the specific requirements of the placement

*Tasks:* details of activities eg specific hourly, daily, weekly routine and non-routine tasks; breakdown of a project into stages; new procedures/protocol

*Prioritise:* reasons for rationalisation of the order of tasks; methods of prioritising work

*Plan for the work experience:* methods used to develop detailed plan with schedule of tasks, proposed dates for reviews, expected input from supervisors

*Benefits to organisation and learner:* advantages to business eg allowing more routine tasks to be carried out, allowing procedures/techniques to be developed, increasing responsiveness, identifying cost saving measures; advantages to learner eg understanding how a business operates, understanding importance of teamwork, learning new techniques, development of problem-solving and time-management skills

### 3 Be able to undertake work experience as identified

*Carry out the planned activities:* realisation eg carrying out tasks and project work according to relevant legislation, training and codes of practice; developing new procedures or protocol

*Record activities in the appropriate manner:* systematic and appropriate recording of relevant activities eg logbook, diary, portfolio, spreadsheets, data bases; list of resources

*Revise the initial plan as required:* methods used to review activities at the appropriate time to see if they meet requirements, make alterations as needed

#### 4 Be able to monitor and evaluate own performance and learning

*Evaluation of the quality of the work undertaken:* meeting industry standards and evaluating own performance against original proposal; comments/testimony from supervisors

*Account of learning during the work experience:* details of experience gained eg new procedures, interpersonal skills, time management, problem solving, teamwork; details of evidence eg portfolio of evidence, scientific report, management report

*Recommendations on how the learning experience could have been enhanced:* alternative ideas eg different location, different brief, different time period, more/less support, better time management, better preparation

## Learning outcomes and assessment criteria

Learning outcomes  On successful completion of this unit a learner will:	Assessment criteria for pass  The learner can:
LO1 Be able to negotiate industry experience	1.1 research and evaluate suitable organisations that could provide industry experience 1.2 negotiate with work and academic supervisors a proposal for the work experience 1.3 recognise the business constraints on the work experience offered
LO2 Understand the specific requirements of the placement	2.1 agree and prioritise the tasks and responsibilities involved in the work experience 2.2 produce a plan for the work experience 2.3 analyse the benefits of the proposed activities to the business and the learner
LO3 Be able to undertake work experience as identified	3.1 fulfil specified requirements of placement conforming to all related codes of practice 3.2 produce systematic records of work undertaken 3.3 revise the initial plan as required 3.4 make suggestions for improvement and review these with appropriate supervisor
LO4 Be able to monitor and evaluate own performance and learning	4.1 monitor progress against original proposal 4.2 evaluate the quality of own performance 4.3 analyse the learning which has taken place during the work experience using suitable reflections 4.4 make recommendations on how the experience could have been enhanced.



## Guidance

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### Links

This unit has possible links with all units in the programme, especially the *Personal and Professional Development* and *Employability Skills* units.

This unit has links to the Management and Leadership NOS.

### Essential requirements

Given the work-based nature of this unit, the majority of resources will be those available to the learner in the workplace. The work will normally be planned to be achievable within the resource constraints of the employer. Therefore, knowledge of company structures and daily routines and expectations are essential. Learners should also have access to a wide range of research facilities including careers library and/or careers services.

Tutor support and guidance are essential. Learners should remain in touch with tutors during the work experience – email is often the best way but some colleges may have access to a virtual learning environment where learners can share information and experiences with each other and the tutor.



## Unit 51: Computer Systems Architecture

<b>Unit code:</b>	<b>J/601/2003</b>
<b>QCF Level 3:</b>	<b>BTEC National</b>
<b>Credit value:</b>	<b>10</b>
<b>Guided learning hours:</b>	<b>60</b>

### ● Aim and purpose

To enable learners to understand the underlying architecture and components behind the functioning of computer systems.

### ● Unit introduction

All computer systems share the same underlying computer architecture principles. This unit examines these principles and explores the fundamentals of how computer systems work. Learners will focus on the technical detail including how the components function at an electronic level.

Learners will explore how various types of data can be represented and then stored within computer systems. This is followed by a study of the low-level system components. It includes the processor, buses and memory incorporating an analysis of how these components interact to manipulate data using the fetch-execute cycle. Low-level program instructions make up the fetch-execute cycle and simple assembly code instructions are investigated along with their interaction with the various registers that make up the Central Processing Unit (CPU). Learners will have the opportunity to develop simple programs in a low-level language.

### ● Learning outcomes

**On completion of this unit a learner should:**

- 1 Understand how data can be represented within computer systems
- 2 Understand the functions of computer system components
- 3 Understand the principles of processor operations.

## Unit content

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### 1 Understand how data can be represented within computer systems

*Numeric data:* conversions between different representations of data; representing integer numbers in different number bases; converting between number bases using integer numbers eg denary to binary, denary to hexadecimal, binary to hexadecimal; performing arithmetic operations in different number bases; representing fixed-point numbers in different number bases; representing floating-point numbers in binary

*Boolean logic:* logic gates; truth tables; use of logic gates in integrated circuits; logical operations eg AND, OR, NOT, NAND, NOR, XOR

*Coding of data:* sign and magnitude; two's complement; floating point; binary coded decimal; coding of character data eg ASCII (American Standard Code for Information Interchange)

*Types of data:* representing bit patterns for different types of data eg graphics, video, audio and other data; graphics eg bitmap (resolution, colour depth, file calculations), vector (objects, properties); sound (compression, sampling resolution, sampling rate, streaming audio, quality); video (compression, encoding, streaming, quality); analogue data; digital data; analogue signals; digital signals; data conversion eg analogue to digital; file formats eg mp3, mp4, wav, avi

### 2 Understand the functions of computer system components

*Key components:* Central Processing Unit (CPU); memory; interfaces; clock; buses, diagrammatic representation; Von Neuman architectures

*Central Processing Unit:* control unit; ALU (Arithmetic Logic Unit); general purpose registers; special purpose registers eg instruction pointer, accumulator; core eg single, multiple; features eg pipelining, multiprocessing, parallel processing; polling; interrupts

*Memory:* I/O maps; Direct Memory Access (DMA); ROM (Read Only Memory); cache; RAM (Random Access Memory) eg static, dynamic, flash

*Buses:* system bus; address bus; control bus; physical connections to components eg Central Processing Unit, memory, input/output (I/O) devices, system buses

*Peripherals:* types eg hard disc, printer, scanner, network card

### 3 Understand the principles of processor operations

*CPU instruction sets:* Reduced Instruction Set Computer (RISC); Complex Instruction Set Computer (CISC); clock rate; performance levels

*Addressing:* modes eg immediate; relative; address bus; addressing in the fetch-execute cycle

*Machine operations:* how they are organised and represented; role of the instruction decoder; low-level programs; assembly code instructions eg fetch, load, add; decision making and branching; using registers, transferring data between registers, fetch-execute cycle; program storage; data storage; addressing

## Assessment and grading criteria

In order to pass this unit, the evidence that the learner presents for assessment needs to demonstrate that they can meet all the learning outcomes for the unit. The assessment criteria for a pass grade describe the level of achievement required to pass this unit.

Assessment and grading criteria		
To achieve a pass grade the evidence must show that the learner is able to:	To achieve a merit grade the evidence must show that, in addition to the pass criteria, the learner is able to:	To achieve a distinction grade the evidence must show that, in addition to the pass and merit criteria, the learner is able to:
P1 explain using examples how numeric and alphanumeric data can be coded within a computer system		
P2 explain using examples how different types of data can be converted and stored in computer systems		
P3 convert numeric data between different number systems including floating point	M1 explain using examples how floating point numbers can be represented in binary	
P4 carry out Boolean logic operations		
P5 illustrate the key computer system components and how they interact		
P6 explain the different types of memory that can be attached to a processor	M2 compare the roles played by different types of memory	D1 explain how the processor is physically connected to memory and input/output (I/O) devices using the system buses
P7 explain how polling and interrupts are used to allow communication between processor and peripherals		

Assessment and grading criteria		
To achieve a pass grade the evidence must show that the learner is able to:	To achieve a merit grade the evidence must show that, in addition to the pass criteria, the learner is able to:	To achieve a distinction grade the evidence must show that, in addition to the pass and merit criteria, the learner is able to:
P8 compare Reduced Instruction Set Computer (RISC) chips and Complex Instruction Set Computer (CISC) chips		
P9 illustrate the use of the different processor registers in the fetch-execute cycle.	M3 create a low-level program which includes decision making and branching.	D2 explain how the width of the data bus and address bus affect processor performance and complexity.

## Essential guidance for tutors

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### Delivery

It is recommended that this unit is delivered either after or in conjunction with *Unit 2: Computer Systems*.

Simulation software could be used extensively in this unit for example to develop learners' understanding of logic gates and low-level programming. Other software that simulates the internal operation of the processor would also be valuable to confirm learners understanding.

Alternatively, a software application that simulates a simple CPU and an associated assembly language could be used. This type of software usually covers the basic elements of assembly language programming. Learners are able to put the theory into practice using the simulator to run programs in a controlled way, seeing all CPU activity step by step.

LO1 should be delivered using a series of worksheets to deliver the maths theory and Boolean logic operations. It's important to link the number theory to computer activity, noting that at the lowest level binary represents the off/on nature of electricity. For example, hexadecimal is a user-friendly way of representing binary and is used in electronics and computing. Use of binary and hexadecimal in IP addressing (versions 4 and 6) could be demonstrated.

For LO2 and LO3, the CPU can be introduced as the part of the computer architecture that runs computer programs. This is facilitated by the fetch-execute cycle and this could be explained in conjunction with a simple assembly language program that, for example, adds two numbers together. This could then be used to introduce learners to the different registers that make up the CPU. The functions of the various buses and the different types of memory could then be covered.



## Outline learning plan

The outline learning plan has been included in this unit as guidance and can be used in conjunction with the programme of suggested assignments.

The outline learning plan demonstrates one way in planning the delivery and assessment of this unit.

Topic and suggested assignments/activities and/assessment
<b>Introduction to the unit</b> How data is represented within a computer system: <ul style="list-style-type: none"> <li>• whole-class exercise – tutor presentation on numeric data, followed by practical exercise</li> <li>• whole-class exercise – tutor presentation on coding of data, followed by practical exercise</li> <li>• whole-class exercise – tutor presentation on representing analogue data, followed by practical exercise</li> <li>• a mixture of practical exploration of the technologies, learner exercises, case studies and detailed investigation.</li> </ul>
<b>Assignment 1 – The Devil is in the Data</b> Low-level components of computer systems: <ul style="list-style-type: none"> <li>• whole-class exercise – tutor presentation on architecture components, followed by practical exercise</li> <li>• whole-class exercise – tutor presentation on processors, followed by practical exercise</li> <li>• whole-class exercise – tutor presentation on busses, followed by practical exercise</li> <li>• whole-class exercise – tutor presentation on memory, followed by practical exercise</li> <li>• a mixture of practical exploration of the technologies, learner exercises, case studies and detailed investigation.</li> </ul>
Processor operations: <ul style="list-style-type: none"> <li>• whole-class exercise – tutor presentation on the operation and use of logic gates, followed by practical exercise</li> <li>• whole-class exercise – tutor presentation on representation of gates and logical circuits, followed by individual exercise</li> <li>• whole-class exercise – tutor presentation on gate and logic circuits, followed by practical exercise</li> <li>• mixture of practical exploration of the technologies, learner exercises, case studies and detailed investigation.</li> </ul>

**Topic and suggested assignments/activities and/assessment****Assignment 2 – The Data Driver**

Low level programming:

- whole-class exercise – tutor presentation on low-level programs, followed by practical exercise
- whole-class exercise – tutor presentation on addressing modes, followed by practical exercise
- individual exercise – research into uses of low-level programs
- learners will need access to practical resources and suitable technology, they can also use simulators or multimedia tools to gain prior experience before handling 'live resources' if available.

**Assignment 3 – Low-level Programmer****Assessment**

To achieve a pass grade, learners must achieve the nine pass criteria listed in the grading grid.

To achieve a merit grade, learners must achieve all of the pass grade criteria and the three merit grade criteria.

To achieve a distinction grade, learners must achieve all of the pass and merit grade criteria and the two distinction grade criteria.

**Suggested Assignment 1 – The Devil is in the Data**

For P1, appropriately designed short test questions could show understanding; alternatively some worked examples in a controlled open book environment would be appropriate. Whatever method is used, learners must explain in their own words how data can be coded, and must use examples within their explanation.

For P2, learners could use combinations of diagrams, and descriptions that show coverage of the different types of data in the unit content. Alternatively, a presentation and demonstration could be appropriate.

P3 could be assessed through conventional testing, however learners do not need to be 100 per cent correct in all conversions in order to achieve this criterion but they must eventually show competence. Evidence of learners' workings should be provided.

For P4, learners must carry out Boolean logic operations as specified in the content. This could be assessed through conventional testing as long as the criterion is covered. Evidence of learners' workings must be provided.

For M1, learners could investigate for example, single and double precision floating point and show how numbers are stored in 16, 32, 64 bit etc registers.

**Suggested Assignment 2 – The Data Driver**

For P5, a complex and annotated diagram or series of related diagrams could be appropriate, perhaps stored in a web page with appropriate detail stored in hot spots. Confirmation of learners' understanding could be gained using a discussion, which if suitably documented could also be part of the evidence.

For P6, a written report, presentation or web document could be used to explain the different types of memory attached to a processor.

For M2, learners could look at the role of processor cache memory, main memory and DMA.

For D1, learners could produce a diagram showing schematically the connectivity between processor and I/O devices with an explanation of, for example, how a document is printed or how a file is retrieved from disk.

**Suggested Assignment 3 – Low-level Programmer**

For P7, written responses to a series of scenarios could be used to generate evidence.

For P8, learners could research the different types of chips and look at the performance advantages and disadvantages of each.

For P9, learners could show diagrammatically the different registers involved in running a simple programme that, for example, adds two numbers together incorporating the fetch-execute cycle.

For M3, learners should produce listings of the programs, together with a statement from the tutor confirming that the program is valid.

For D2, learners could research bit sizes of current address and data buses and explain the effect these have on performance.

### Programme of suggested assignments

The table below shows a programme of suggested assignments that cover the pass, merit and distinction criteria in the assessment and grading grid. This is for guidance and it is recommended that centres either write their own assignments or adapt any Edexcel assignments to meet local needs and resources.

Criteria covered	Assignment title	Scenario	Assessment method
P1-P4, M1	The Devil is in the Data	<p>A series of mathematical exercises based on number conversions using different representations of data.</p> <p>A series of Boolean algebra exercises demonstrating use of logic diagrams.</p>	<p>Website/portfolio</p> <p>Presentation</p>
P5, P6, M2, D1	The Data Driver	A company requests a report illustrating how the key computer system components and how they interact. A further extension to explain different types of memory, and the role they play in computer systems.	<p>Poster</p> <p>Presentation</p>
P7-P9, M2, M3, D2	Low-level Programmer	<p>A company requests further information about the relationship with the processor and peripherals. The company wants a comparison of RISC and CISC to help their understanding of computer systems architecture.</p> <p>A company asks you to demonstrate assembly programming by creating a simple low-level program for a specific need.</p>	<p>Documentation</p> <p>Working program</p>

## Links to National Occupational Standards, other BTEC units, other BTEC qualifications and other relevant units and qualifications

This unit forms part of the BTEC in IT sector suite. This unit has particular links with the following unit titles in the IT suite:

Level 2	Level 3	Level 4
Unit 3: Computer Systems	Unit 2: Computer Systems	Unit 2: Computer Systems

This unit maps to some of the underpinning knowledge from the following areas of competence in the Level 2 National Occupational Standards for IT (ProCom):

- 4.1 Systems Architecture.

## Essential resources

Learners must have access to practical resources and suitable technology, they can also use simulators or multimedia tools to gain prior experience before handling 'live resources' if available.

## Indicative reading for learners

### Textbooks

Blum R – *Professional Assembly Language Programming* (John Wiley & Sons, 2005)  
ISBN-10 0764579010, ISBN-13 978-0764579011

Gaura E, Hibbs D and Newman R – *Computer Systems Architecture* (Lexden, 2008)  
ISBN-10 1904995098, ISBN-13 978-1904995098

Goodstein R – *Boolean Algebra* (Dover, 2007) ISBN-10 0486458946, ISBN-13 978-0486458946

### Website

[freecomputerbooks.com/compscArchitectureBooks.html](http://freecomputerbooks.com/compscArchitectureBooks.html)

## Unit 52: Spreadsheet Modelling

**Unit code:** Y/601/6637

**QCF Level 3:** BTEC Nationals

**Credit value:** 10

**Guided learning hours:** 60

### ● Aim and purpose

To enable learners to use complex spreadsheet modelling in order to support organisational activities such as credit control, sales forecasting and stock analysis.

### ● Unit introduction

Spreadsheets are key software for many businesses and organisations, helping them to keep track of numerical information and analyse it quickly and more easily than with paper records.

Accounting and finance use spreadsheets to record the transactions made by organisations. They have replaced manual pages in ledgers, where income and expenditure are organised into rows and columns. Users can make use of inbuilt functionality to help them to understand the data without needing specialist mathematical skills.

Utilities such as ordering, sorting and filtering will show the same data in different ways. Charts and graphs help to display information more visually. Complex calculations can be carried out using library functions or users can choose to create their own formulae.

One of the main advantages of spreadsheet software is that it can be customised with buttons and macros. IT practitioners can use many features, for example to restrict user access to whole workbooks, spreadsheets or parts of spreadsheets.

Spreadsheets can be saved in a number of different formats. The most useful format is comma separated value (csv), as this particular format can be read by many applications which means that data created in one type of spreadsheet software can be exported easily to other programs. This technology enables organisations to be more knowledgeable about their own activities. This, in turn, allows managers to make decisions more quickly which can lead to organisations gaining competitive advantage.

As IT practitioners, learners will need to be able to use spreadsheet software competently as well as being able to support users as part of a technical or helpdesk role.

● **Learning outcomes**

**On completion of this unit a learner should:**

- 1 Understand how spreadsheets can be used to solve complex problems
- 2 Be able to develop complex spreadsheet models
- 3 Be able to automate and customise spreadsheet models
- 4 Be able to test and document spreadsheet models.



## Unit content

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### 1 Understand how spreadsheets can be used to solve complex problems

*Use of spreadsheets:* manipulating complex data; presentation to requirements; supporting decision making eg analysis of data, goal seeking, scenarios, regression, data mining

*Complex problems:* types eg cash flow forecasting, budget control, what-if scenarios, sales forecasting, payroll projections, statistical analysis, trend analysis

*Interpretation:* methods eg comparisons of totals, trend analysis

### 2 Be able to develop complex spreadsheet models

*Complexity:* multiple worksheets (with links); complex formulae eg at least two-step process; large data sets; cells linkage; data entry forms eg menu systems, list boxes, drop-down boxes, event controls; data validation; error trapping; lookup tables; nested IF functions; templates; cell protection

*Formulae:* relative references; absolute references; logical functions eg IF, AND, OR, NOT, SUMIF; correct operators

*Structure and fitness for purpose:* formatting eg integer, real, date, currency, text; styling eg bold, italics, borders, shading, column alignment, consistency; context

*Features and functions:* named ranges; file sharing; tracking changes; security issues; user interface; add-ins; built-in functions eg cell functions, lookup functions, text functions, statistical function; finding data

*Refine:* improving efficiency eg shortcuts, aiding navigation; formatting eg fonts, page orientation, header and footer, print area, use of colour, conditional formatting

### 3 Be able to automate and customise spreadsheet models

*Sorting and summarising data:* use of sub-totals and facilities eg pivot tables; sorting data on multiple fields; filtering data sets

*Tools:* charts and graphs eg titles; labels eg axis scales, colours, annotation; select appropriate type eg line, bar, column, pie, xy (scatter)

*Presenting:* combining information eg table of data and chart; maintaining data eg between worksheets, workbooks, packages

*Analysing and interpreting data:* convert data eg charts, graphs; lists eg filtering, sorting; trends; patterns; data analysis; results; conclusions

*Customisation:* restricting data entry eg hiding; protecting; modifying toolbars; modifying menus; checking data eg data validation, range checking, not NULL; error messages

*Automation:* methods eg macros, ActiveX control, Control Toolbox, Visual Basic

#### 4 Be able to test and document spreadsheet models

*Test:* manual calculations eg formula, functions; data entry forms; validation; calculations; correct outcomes eg layout, values; suitability for client; user testing; test plans using normal, extreme and erroneous data

*Feedback:* methods eg surveys, questionnaire, interview; analyse results; make recommendations

*Alternative formats:* converting to eg xls, csv, txt, xms, xml, html

*Documentation:* user documentation eg instructions, guide, troubleshooting; technical documentation eg hardware resources, software resources; instructions; calculations eg formula, functions used; validation procedures

## Assessment and grading criteria

In order to pass this unit, the evidence that learners presents for assessment needs to demonstrate that they can meet all the learning outcomes for the unit. The assessment criteria for a pass grade describe the level of achievement required to pass this unit.

Assessment and grading criteria		
To achieve a pass grade the evidence must show that the learner is able to:	To achieve a merit grade the evidence must show that, in addition to the pass criteria, the learner is able to:	To achieve a distinction grade the evidence must show that, in addition to the pass and merit criteria, the learner is able to:
P1 explain how spreadsheets can be used to solve complex problems		D1 discuss how organisations can use interpretation methods to analyse data
P2 develop a complex spreadsheet model to meet particular needs	M1 refine a complex spreadsheet model by changing rules and values	
P3 use formulae, features and functions to process information		
P4 use appropriate tools to present data	M2 analyse and interpret data from a spreadsheet model	
P5 customise the spreadsheet model to meet a given requirement		
P6 use automated features in the spreadsheet model to meet a given requirement	M3 compare different automation methods	
P7 test a spreadsheet model to ensure that it is fit for purpose		D2 evaluate a spreadsheet model incorporating feedback from others and make recommendations for improvements.
P8 export the contents of the spreadsheet model to an alternative format		
P9 produce user documentation for a spreadsheet model.	M4 produce technical documentation for a spreadsheet model.	

## Essential guidance for tutors

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### Delivery

This unit assumes learners have a basic understanding of spreadsheets and spreadsheet terminology. The unit should be delivered in a room containing computers so that learners can work through sample exercises or other source materials. Using practical examples, the activities undertaken in this unit should, if possible, be contextualised so learners gain the maximum benefit from learning about concepts.

Tutors should expect that the majority of time will be allotted to practical tasks, which will require, for most of the tasks and exercises, each learner to have access to a computer with some form of spreadsheet software installed.

For most of the practical work, it is strongly recommended that the tutor provide learners with a prepared spreadsheet. Ideally, these spreadsheets could be created for a specific business scenario. For instance, a spreadsheet could be created with a business's financial management in mind. Spreadsheets are normally designed to use advanced formulae and make use of many of the spreadsheet's advanced functions.

Another example of practical spreadsheet use is as a research tool for recording and analysing statistical information.

For the directed research exercises, the tutor could also give learners material to help them in directed research tasks. This material could come from a variety of sources, including websites specialising in advanced use of spreadsheet software, and from textbooks within the centre.

However, the tutor could also recommend a list of suitable textbooks that learners could obtain from local libraries, which could also help in research exercises. Most spreadsheet programs come with 'Help' functions that contain extensive 'How To' guides, and the tutor could also recommend that learners use these as research aids.

## Outline learning plan

The outline learning plan has been included in this unit as guidance and can be used in conjunction with the programme of suggested assignments.

The outline learning plan demonstrates one way in planning the delivery and assessment of this unit.

### Topic and suggested assignments/activities and/assessment

#### Introduction to the unit

Using spreadsheets to solve problems:

- whole-class exercise – tutor presentation on how to use spreadsheets for complex tasks
- whole-class exercise – begin using the spreadsheet to solve complex problems
- individual exercise – from tutor-prepared materials learn advanced formulae and use on a spreadsheet
- directed research – find out the different ways in which a spreadsheet can be used to interpret complex data sets.

#### Assignment 1 – Embracing Complexity

Complex models:

- whole-class exercise – tutor presentation on creating and using complex spreadsheets with advanced formulae, features and functions
- individual exercise – from tutor-prepared material look at higher-level formulae, features and functions
- whole-class exercise – tutor presentation on formatting and styling
- whole-class exercise – tutor presentation on how to automate and customise spreadsheet models using macros, Active X control, Visual Basic
- whole-class exercise – tutor presentation on what sorting and summarising data means, why it's needed and how it can be done
- whole-class exercise – tutor leads lesson on charts/graphs and how to manipulate them
- individual exercise – learner works from tutor-prepared materials to understand how to automate and customise spreadsheets.

Topic and suggested assignments/activities and/assessment
<b>Assignment 2 – Making it Presentable</b>
Test and document: <ul style="list-style-type: none"> <li>individual exercise – learner works from tutor-prepared materials to test spreadsheet models and document test plans</li> <li>whole-class exercise – tutor leads lesson on methods for capturing feedback and how to interpret the results from feedback</li> <li>individual exercise – learner works from tutor-prepared materials to produce user and technical documentation</li> <li>whole-class exercise – learn about conversion to other file formats.</li> </ul>
<b>Assignment 3 – Going to the Next Level</b>

### Assessment

At this level, assessment is probably suited to assignments in the form of a mini project, where learners can apply all the principles of the unit to one business problem.

To achieve a pass grade, learners must achieve the nine pass criteria listed in the assessment and grading criteria grid.

For P1, learners will need to explain how spreadsheets can be used to solve complex problems, and they should provide examples to support their explanation.

For P2, learners will need to develop a complex spreadsheet model, where 'complex' requires that the spreadsheet contains some aspects of the following range: multiple worksheets (with links), complex formulae, for example at least two-step process, large data sets, cells linkage, data entry forms, for example menu systems, list boxes, drop-down boxes, event controls, data validation, error trapping, lookup tables, nested IF functions, templates, and cell protection.

For P3, learners should solve a complex problem using formulae and functions in the spreadsheet. This might best be through a supplied scenario such as a cash flow forecast, a budgeting problem, 'what if' analysis, payroll projections or another similar scenario. This should include some aspects of the following range: relative references, absolute references, logical functions, for example IF, AND, OR, NOT, SUMIF, correct operators, named ranges, file sharing, track changes, security issues, user interface, add-ins, built-in functions, for example cell functions, lookup functions, text functions, statistical function and finding data.

P4 requires learners to create charts and graphs from numeric data sets. This can be either the same data used in different graphical images, or a number of different charts or graphs created from different data. Tutors should ensure that learners have created charts and graphs that are fit for purpose, they should contain appropriate titles, labels, axis scales and suitable colours, and that the chart or graph should be of the appropriate type. This would be achieved most successfully by giving learners a user need that requires them to select an appropriate graphical image from a possible range.

For P5, learners must customise the spreadsheet model. Examples of customisation include restricting data entry, for example hiding information, protecting worksheets and cells, modifying toolbars and menus, checking data, for example data validation, range checking, not NULL and display error messages.

For P6, learners should be able develop the spreadsheet model further by implementing automated features, such as macros, Active X control, Control Toolbox or Visual Basic.

For P7, learners should check the accuracy of the spreadsheet model. For example, evidencing that they have checked the spreadsheet model both in terms of the required functionality, accuracy of calculations, data validation, and to appropriate levels of detail (columns for example to two decimal places). Evidence should be in the form of test plans.

P8 could be evidenced through an observation and witness statement where learners demonstrate converting a spreadsheet file to an alternative format, and importing the converted file into the relevant software, for example an html file opened and printed successfully from a browser.

For P9, learners must produce user documentation with instructions on how to use the spreadsheet model, especially when navigating with user interfaces.

To achieve a merit grade, learners must achieve all the pass and the four merit criteria.

M1 builds on P2 by requiring learners to refine their complex spreadsheet model to improve efficiency. Examples include introducing shortcuts, or other methods to aid navigation, as well as improving the presentation by applying different styles and formatting techniques. The spreadsheet model must be presentable and user friendly.

For M2, learners can use the graphs or charts they have developed for P4 as a method of analysing and interpreting data from their spreadsheet model. Alternatively, learners could use sub-totals or pivot tables, data sorting and data comparison (trends for example) techniques to analyse data. Learners will need to demonstrate that they are using these techniques to interpret the complex spreadsheet model.

M3 builds on P6 by requiring learners to compare different automation methods including macros, Active X control, Control Toolbox and Visual Basic.

M4 builds on P9 by requiring learners to produce technical documentation which includes the required hardware and software resources, instructions and an explanation of calculations used in the spreadsheet model.

To achieve a distinction grade, learners must achieve all the pass, merit criteria and two distinction criteria.

D1 builds on P1 by discussing further how organisations can use interpretation methods to analyse data.

Finally, for D2, learners must evaluate their spreadsheet model and consider feedback from others. Learners should be able to reflect on their performance in building a spreadsheet model, and what hurdles they have overcome to achieve the desired result. Did the spreadsheet model meet the given requirements? What did other people think of the spreadsheet model? Learners must also include sensible recommendations for improvements.

### Programme of suggested assignments

The table below shows a programme of suggested assignments that cover the pass, merit and distinction criteria in the assessment and grading grid. This is for guidance and it is recommended that centres either write their own assignments or adapt any Edexcel assignments to meet local needs and resources.

Criteria covered	Assignment title	Scenario	Assessment method
P1, D1	Embracing Complexity	A company has asked you to provide information on how spreadsheets can be used to solve complex problems, and how to use tools to analyse data.	Theory/practical exercises
P2–P6, M1–M3	Making it Presentable	<p>You have convinced the company that spreadsheet models are the best way to analyse data. The company wants you to develop a complex spreadsheet to meet their needs. Exploit the full use of spreadsheet software by using advanced formulae, features and functions, and present data using charts and graphs.</p> <p>The company is now looking to take its work on sophistication even further, exploiting the software as much as it can with automated features.</p>	Portfolio



Criteria covered	Assignment title	Scenario	Assessment method
P7–P9, M4, D2	Going to the Next Level	<p>The company would like to feel comfortable knowing that the spreadsheet model has been fully tested. Perform testing of the spreadsheet model.</p> <p>The company would also like to train their staff on the use of the spreadsheet model.</p>	Portfolio

### Links to National Occupational Standards, other BTEC units, other BTEC qualifications and other relevant units and qualifications

This unit forms part of the BTEC in IT sector suite. This unit has particular links with the following unit titles in the IT suite:

Level 1	Level 2	Level 3
	Unit 27: Spreadsheet Modelling	

### Essential resources

Learners will need access to appropriate hardware and software.

## Employer engagement and vocational contexts

The use of vocational context is essential in the delivery and assessment of this unit. Learners will require access to computer equipment to enable them to gain a practical awareness and enable them to apply their knowledge and understanding in a practical situation.

There is a range of organisations that may be able to help to centres engage and involve local employers in the delivery of this unit, for example:

- Learning and Skills Network – [www.vocationallearning.org.uk](http://www.vocationallearning.org.uk)
- Local, regional business links – [www.businesslink.gov.uk](http://www.businesslink.gov.uk)
- National Education and Business Partnership Network – [www.nebpn.org](http://www.nebpn.org)
- Network for Science, Technology, Engineering and Maths Network Ambassadors Scheme – [www.stemnet.org.uk](http://www.stemnet.org.uk)
- Work-based learning guidance – [www.aimhighersw.ac.uk/wbl.htm](http://www.aimhighersw.ac.uk/wbl.htm)
- Work Experience/Workplace learning frameworks – Centre for Education and Industry (CEI University of Warwick) – [www.warwick.ac.uk/wie/cei](http://www.warwick.ac.uk/wie/cei).

## Indicative reading for learners

### Textbooks

Day A – *Mastering Financial Mathematics with Excel* (Financial Times Prentice Hall, 2005) ISBN 0764597809

Hart-Davis G – *How to Do Everything with Microsoft Office Excel 2003* (McGraw-Hill Education, 2003) ISBN 0072230711

Heathcote R – *Further Excel 2000-2003* (Payne-Gallway Publishers, 2004) ISBN 1904467768

Koneman P – *Advanced Projects for Microsoft Excel 2000* (Prentice Hall, 2000) ISBN 0130885444

Simonn J – *Excel Data Analysis, 2nd Edition* (Hungry Minds Inc US, 2005) ISBN 0764597809

Zapawa T – *Excel Advanced Report Development* (Hungry Minds Inc US, 2005) ISBN 0764588117

### Websites

<http://office.microsoft.com/en-us/excel/default.aspx>

<http://support.openoffice.org/index.html>

[www.free-training-tutorial.com](http://www.free-training-tutorial.com)

## Unit 53: Web Server Scripting

<b>Unit code:</b>	<b>A/601/0443</b>
<b>QCF Level 3:</b>	<b>BTEC National</b>
<b>Credit value:</b>	<b>10</b>
<b>Guided learning hours:</b>	<b>60</b>

### ● Aim and purpose

To enable understand and use web server scripting and investigate the common issues surrounding its use.

### ● Unit introduction

When designing and building websites, a key issue for developers is the amount of control they can exert over how tasks are carried out. Client-side scripting embedded in web pages can give additional functionality but, because the code is executed after the page has been loaded, there is little control and this approach can lead to hacking vulnerabilities and errors.

Web server scripting is code written 'server-side' and executed before the page is loaded. This means that complex tasks can be created and programming is generally more secure. The skills and knowledge developed in this unit are particularly valuable because security and reliability are common issues for businesses.

The types of operation that can be influenced include handling files on the server, security systems such as password protection, and accessing databases. Server scripting can be used, for example, to gather statistics about the website, including how many visitors have viewed each page. Data such as this can be used to generate revenue from people wishing to advertise on a popular website.

Another function that web server scripting can relate to is the use of environmental arguments. The user's computer system is scanned to obtain their screen resolution, browser type and other information. Each web page in a website can be made several times to suit a variety of environments. The user is then automatically redirected to the page which best suits their environment. This facility can enhance user enjoyment but has ethical implications if used inappropriately.

Learners will understand the principles of server-side web scripting and be able to create functionality using a web server script. Learners should also understand the security and ethical issues surrounding this area of IT.

● **Learning outcomes**

**On completion of this unit a learner should:**

- 1 Understand the principles of web server scripting
- 2 Be able to use web server scripting
- 3 Understand the issues affecting web server scripting.

## Unit content

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### 1 Understand the principles of web server scripting

*Web server scripting languages:* server-side versus client-side; web server scripting languages eg ASP, JSP, PHP, Cold Fusion, Perl, Ruby on Rails, Django

*Functionality:* functions eg shopping cart, reserve order, manage user profile, web content management, upload files, website analysis

*Features:* advantages eg interpreted scripts as alternative to compiled code, run as lower overhead code inside web server plugins, hide web server interface inside economical APIs; disadvantages eg increased complexity, reduced performance, code is interpreted not compiled

*Accessibility:* features eg alternative text, resizable fonts, support for screen readers, adjustable fonts.

### 2 Be able to use web server scripting

*Programming:* functionality eg file manipulation such as uploading, security features such as login systems and error logging, accessing databases, generating statistics, environmental arguments

*Documentation:* requirements specification; internally documented code

*Testing and debugging:* test plan structure eg test, date, expected result, actual result, corrective action; error messages; other eg specialist software debugging tools

### 3 Understand the issues affecting web server scripting

*Security:* specific problems eg coding vulnerabilities, bad scripting leaving backdoors, SSL, password liabilities

*Ethical:* issues eg scanning PCs without consent, faking statistics to obtain advertising deals based on visitor numbers

## Assessment and grading criteria

In order to pass this unit, the evidence that the learner presents for assessment needs to demonstrate that they can meet all the learning outcomes for the unit. The assessment criteria for a pass grade describe the level of achievement required to pass this unit.

Assessment and grading criteria		
To achieve a pass grade the evidence must show that the learner is able to:	To achieve a merit grade the evidence must show that, in addition to the pass criteria, the learner is able to:	To achieve a distinction grade the evidence must show that, in addition to the pass and merit criteria, the learner is able to:
P1 explain the principles of web server scripting	M1 compare server-side and client-side scripting	D1 evaluate the combined use of client and web server scripting
P2 use web server scripting to identify a user's browser and screen resolution		
P3 upload files to a web server using web server scripting	M2 edit the content of a text file on a web server using web server scripting	
P4 implement, test and document a simple login system using web server scripting	M3 create a multi-user, dynamic login system using web server scripting	
P5 implement, test and document a web content management system to meet a defined need	M4 implement an error log for a website using web server scripting.	D2 create a web application to generate website statistics using web server scripting
P6 explain the issues surrounding web server scripting.		D3 recommend ways to improve web security when using web server scripting.

## Essential guidance for tutors

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### Delivery

Learning outcome 1 could define what web server scripting is and what languages are used, together with an appreciation of what can be carried out server side as opposed to client side. It is probably easiest to deliver this by whole-class teaching, possibly backed up with handouts and using some directed study to add interest.

This basic understanding will lead into the advantages of web server scripting. A useful method is for the class to put forward their ideas of advantages, possibly in small groups feeding back to the whole, and then for the tutor to lead a discussion on the items they put forward. The tutor can ensure that the final list covers the main elements (see the unit content learning outcome 1).

Having discussed the advantages it is essential that learners are aware of the disadvantages of web server scripting. This can be delivered in a similar way to the advantages, and there may be benefits from delivering the two elements together.

Having dealt with the background to the subject, delivery of the practical aspects is next. Learning outcome 2 involves using a scripting language and could be delivered by the tutor demonstrating a wide a variety of programming techniques followed by learner exercises to gain practise in using the techniques. It is beneficial for learners to see examples of good documentation including explanations of control structures within the code along with suitable test plans. Tutors should demonstrate the use of debugging tools and discuss list of potential error messages and their meanings.

Learning outcome 3 considers security issues and ethical issues. A good way of delivering material on security issues is to get the learners to discuss what they perceive to be issues in this area. They will no doubt have discussed security in other units and it is always good to extract what they already know and transfer that knowledge to a different situation. The tutor can ensure that sufficient real issues are discussed. Using small case studies to consider security issues is a useful way to illustrate the techniques used to recognise these issues.

Finally, learners will address ethical issues. It may be that they will not understand what the term means and a brief introduction by the tutor may be necessary. This could lead on to group discussion that feeds back their thoughts to the whole class. The tutor can lead whole-class discussions. Using case studies to identify ethical issues is a good way of reinforcing the information.

## Outline learning plan

The outline learning plan has been included in this unit as guidance and can be used in conjunction with the programme of suggested assignments.

The outline learning plan demonstrates one way in planning the delivery and assessment of this unit.

Topic and suggested assignments/activities and/assessment
<b>Introduction to the unit</b> Server scripting language: <ul style="list-style-type: none"> <li>• whole-class exercise – tutor presentation on web server scripting languages, followed by practical exercise for learners</li> <li>• individual exercise – using tutor-provided materials, learners work to understand advantages of web server scripting</li> <li>• individual exercise – using tutor-provided materials, learners work to understand advantages of web server scripting.</li> </ul>
<b>Assignment 1 – What is Web Server Scripting?</b> Using web server scripting: <ul style="list-style-type: none"> <li>• whole-class exercise – tutor demonstrates various aspects of programming, followed by class practical</li> <li>• individual exercise – use a tutor-provided checklist of documentation</li> <li>• whole-class exercise – tutor presentation on testing, followed by creating a test plan after looking at examples.</li> </ul>
<b>Assignment 2 – Programming for the Web Server</b> <ul style="list-style-type: none"> <li>• whole-class exercise – tutor-led discussion on specific security problems</li> <li>• whole-class exercise – tutor-led discussion on examples and case studies of ethical issues.</li> </ul>
<b>Assignment 3 – Complete Programming Examples</b>
<b>Assignment 4 – Issues</b>



## Assessment

It is suggested that this unit is assessed using four assignments as summarised in the *Programme of suggested assignments* table.

In the suggested scenario the learners are working for a web development company where they get involved in all sorts of activities. The current activity is to produce materials that will be supplied pre-event to a group of applicants for positions within the company. The information in the materials will be used in the interviewing of the applicants.

Some of the evidence required to complete the assignments could be naturally occurring within their work for other units within the qualification, or for other courses they are undertaking, and tutors are encouraged to use such evidence.

All of the criteria associated with this assignment are to do with writing server side scripts. Note that formal design, documentation and testing are not required for these scripts, although at level 3 one should expect to see some evidence of functionality.

In all cases it is expected that the assessor will supply a statement of authenticity for the learner work.

To gain a pass for the unit, learners must successfully complete all of the pass criteria.

In order to gain a merit grading, learners must achieve all of the pass criteria, and all of the merit criteria.

In order to gain a distinction grading, learners must achieve all of the pass criteria, all the merit criteria and all of the distinction criteria.

### Assignment 1 – What is Web Server Scripting?

P1 is about the principles of web server scripting. The learner will explain the principles incorporating the four areas covered in the content.

Criterion M1 asks for a comparison of server side with client side scripting. This should be about functionality, comparing what can be done with each, the benefit of one over the other and the disadvantages of one over another. Each statement made should be supported with an example.

Criterion D1 asks the learner to evaluate the use of client side scripting and server side scripting together. This should be done by the use of examples. These examples must reflect something where both client side and server side scripting are used together; there is no restriction on what can be used.

### Assignment 2 – Programming for the Web Server

P2 and P3 require the learner to create and implement scripts in a language of their choice.

P2 requires the learner to create a script to identify the user's browser and screen resolution. A copy of the server side script together with the outcome of action (browser and resolution) is the desired evidence for this criterion.

For criterion P3 the learner must create a script to upload a file, for example a text file to the server. Evidence should show the before and after absence and presence of the file together with a copy of the script.

For M2 the script allows editing the content of a text file on the server. This can be the text file loaded for P3 or a different text file. Editing can be anything that demonstrably changes the contents of the file. The change should form part of the evidence together with a copy of the script.

**Assignment 3 – Complete Programming Examples**

P4 and P5 require the learner to create and implement scripts in a language of their choice.

For criterion P4 learners are implementing, testing and documenting a simple login system. Copies of the documented code, statement of need, test plan and results together with any other relevant documentation are the evidence required for this criterion. A similar approach can be used for P5.

M3 involves creating a multi-user dynamic login system, which could be developed from the simple concept undertaken for criterion P4.

For M4 learners are to implement, test and document an error log for a website. Copies of the documented code, statement of need, test plan, test results and any associated document or screen print will form evidence for this criterion.

The script for D2 generates website statistics. Evidence should be a copy of the statistics together with a copy of the script.

**Assignment 4 – Issues**

Evidence for P6 requires the learner to explain security and ethical issue that might arise from the use of web server scripting. This evidence could be presented in an information leaflet, but any form of descriptive evidence would be appropriate.

D3 is an extension of P6

### Programme of suggested assignments

The table below shows a programme of suggested assignments that cover the pass, merit and distinction criteria in the assessment and grading grid. This is for guidance and it is recommended that centres either write their own assignments or adapt any Edexcel assignments to meet local needs and resources.

Criteria covered	Assignment title	Scenario	Assessment method
P1, M1, D1	What is Web Server Scripting?	Your manager has asked you to produce the pre-event material for the applicants of a staff recruitment programme.	Web pages. Annotated prints of the web pages.
P2, P3, M2	Programming for the Web Server	You are to create the scripts the applicants will require for their interview.	Copies of code. Annotated prints. Screen grabs. Statement of authenticity.
P4, P5, M3, M4, D2	Complete Programming Examples	Using web server scripting you are to prepare copies of documentation and testing of scripts for a simple login system and an error log, plus an example of a multi-user system which uses scripts.	Copies of the documentation. Test plan and test results. Copies of scripts. Any additional documentation. Statements of authenticity and functionality.
P6, D3	Issues	You are to produce an information leaflet for the applicants outlining the security and ethical issues surrounding web server scripting.	Information leaflet.

## Links to National Occupational Standards, other BTEC units, other BTEC qualifications and other relevant units and qualifications

This unit forms part of the BTEC in IT sector suite. This unit has particular links with the following unit titles in the IT suite:

Level 1	Level 2	Level 3
Unit 17: Website Development	Unit 20: Client Side Customisation of Web Pages	Web Server Scripting
Unit 34: Website Production	Unit 28: Website Production and Management	Web Applications Development

## Essential resources

This unit maps to some of the underpinning knowledge from the following areas of competence in the Level 3 National Occupational Standards for IT (ProCom):

- 6.2 IT Security Management.

## Indicative reading for learners

### Textbooks

Elliot, G – *Website Management* (Lexden Publishing Limited, 2007) ISBN-10: 1904995217, ISBN-13: 978-1904995210

### Websites

[msdn.microsoft.com/en-us/library/aa239615\(VS.60\).aspx](http://msdn.microsoft.com/en-us/library/aa239615(VS.60).aspx)

[www.build-your-website.co.uk/Server-Scripting.htm](http://www.build-your-website.co.uk/Server-Scripting.htm)

[www.w3schools.com/](http://www.w3schools.com/)

## Unit 54: Multimedia Design

**Unit code:** T/601/0439

**QCF Level 3:** BTEC National

**Credit value:** 10

**Guided learning hours:** 60

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### ● Aim and purpose

To enable learners to understand how multimedia is used in business and be able to create multimedia products to meet business needs.

### ● Unit introduction

The interactive multimedia industry is one of the fastest moving sectors in the world. Those hoping to make a career in this sector will need to be able to produce high quality products which requires creativity, a firm grasp of interactive media design principles and good planning skills. The qualities and skills developed in this unit are applicable to all of the various strands within the interactive media sector.

Learners will develop their understanding of the terminology, nature and scope of the interactive media industry and should be encouraged to investigate a range of existing interactive media products. They will learn how to design professional products by developing core skills (such as how to plan for the use of interactive features, transitions and effects) and applying established principles. They will also have the opportunity to develop and apply creative thinking skills. Learners learn how to plan and manage projects. To ensure that final products are both legal and ethical they will also learn about important issues such as copyright and ownership.

The unit involves the use of authoring software and the creative integration of audio and visual material to produce a final product. It is essential that the product is focused on the business needs of the user. Screen design and layout are important but the final functioning interactive media product created for this unit must meet the business objectives and be easy to use and understand.

Learners will develop an understanding of multimedia products through investigations and experimentation. Competent learners should demonstrate that they are able to select and use a wide range of multimedia software tools and techniques.

● **Learning outcomes**

**On completion of this unit a learner should:**

- 1 Understand how multimedia is used to meet business objectives
- 2 Be able to design multimedia products to meet business needs
- 3 Be able to develop multimedia products
- 4 Be able to present multimedia products
- 5 Be able to review multimedia products.

## Unit content

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### 1 Understand how multimedia is used to meet business objectives

*Multimedia:* types eg sound, animation, still and moving images

*Business requirements:* target audience; purpose; platform

*Business objectives:* promotion and advertising eg web pages, digital posters, virtual tours; education and training eg simulations, e-learning packages; entertainment and leisure eg computer games, virtual reality

*Audience:* profiles eg age, gender, culture, race, class, business, interests, IT literacy

### 2 Be able to design multimedia products to meet business needs

*Multimedia products:* interactive eg information points, digital stories, virtual tours; limited interactivity eg digital posters, adverts, quizzes, movies

*Design:* features eg content, navigation, mix of digital components, interactivity

*Specification:* input methods eg keyboard, mouse, voice recognition, touch screen, stylus, digital video or still camera, microphone; number of pages; features; audience

*Content:* types eg text, images, graphics, video, sound, animation; interactive features eg transitions, menus, submenus, buttons, links, pop-ups, video clips, sound clips; legal requirements: acknowledgment of sources; avoiding plagiarism; permissions; copyright law eg on music downloads, use of images

*Design documentation:* presentation methods eg storyboards, scripts, flow charts, annotations, visuals, timelines; layout eg size, frames, orientation, consistency

### 3 Be able to develop multimedia products

*Combine information:* tools eg insert, size, position, wrap, order, group

*Edit multimedia products:* layout eg size, crop, position, proportion, guides, styles, templates, font, size, orientation, colour, alignment

*File formats:* types eg jpg, png, svg, mp3, mpg

*Test:* review for eg functionality, usability, accessibility, performance, completeness, accuracy; review against requirements

*Quality problems:* sound eg noise, volume; images eg levels, contrast, unwanted content; text eg clarity, spelling, grammar, structure

#### **4 Be able to present multimedia products**

*Display:* devices eg PC, laptop, mobile device, TV

*Display multimedia outcomes:* setup eg quarter screen, full screen, thumbnail, screen resolution, data bandwidth, transmission speeds, output media; constraints eg speed of delivery, size of files, end user hardware and software configuration

*Navigation techniques:* click; scroll; menus; submenus

*Playback:* controls eg start, stop, fast forward, rewind, pause

*Settings:* visual eg brightness, contrast, screen resolution, colour balance, monochrome; sound eg volume, treble, bass, balance; animation eg speed

#### **5 Be able to review multimedia products**

*Gather feedback:* methods eg interview, observation, questionnaire; outcomes eg identify errors, suggest further enhancements, comment on performance

*Test users:* representatives of the target audience



## Assessment and grading criteria

In order to pass this unit, the evidence that the learner presents for assessment needs to demonstrate that they can meet all the learning outcomes for the unit. The assessment criteria for a pass grade describe the level of achievement required to pass this unit.

Assessment and grading criteria		
To achieve a pass grade the evidence must show that the learner is able to:	To achieve a merit grade the evidence must show that, in addition to the pass criteria, the learner is able to:	To achieve a distinction grade the evidence must show that, in addition to the pass and merit criteria, the learner is able to:
P1 explain how multimedia is used to meet business objectives		
P2 design a multimedia product for a specified business need [RL 3]	M1 demonstrate initiative and imagination in meeting user requirements	
P3 identify how the elements of the content will be sourced		
P4 develop a functional multimedia product for a specified business need	M2 demonstrate advanced skills in producing a complex product	D1 produce a complex, high quality, fit for purpose multimedia product
P5 set up software and display devices appropriately to display multimedia outcomes		
P6 review a multimedia product using user feedback.	M3 adapt a product in line with user feedback.	D2 reflect on feedback, suggesting future developments.

## Essential guidance for tutors

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### Delivery

Centres are encouraged to make use of guest speakers from the interactive multimedia industry and arrange visits to local businesses where possible. To keep up to date with developments in the industry it would be useful for learners to attend local trade shows and events organised locally by sector organisations. Subscriptions should be made to some of the many good publications available for each of the sectors both in print and online. The Skillset website ([www.skillset.org](http://www.skillset.org)) is a good source of information, news and statistics with a section dedicated to interactive multimedia.

This unit is intended to develop an understanding of how multimedia products are used to meet business objectives, and a good start point is to look at the range of practical applications of interactive multimedia authoring such as entertainment, education and training; and the formats and platforms to which they are published (eg PC, MAC, kiosks, handheld devices, CD/DVD ROM, web server). Learners should be aware of the work of professional publishers within interactive multimedia and develop knowledge of the skills and techniques associated with appropriate authoring software. This will also help learners to develop a structured critical approach to interactive media production, and provides learners with some idea of the sort of skills they themselves will need to develop.

When delivering the theory aspect of the unit ie legal requirements, formal lectures and independent study should be the main methods for teaching. Advantage should be taken of the websites of the regulatory and professional bodies and learners should be encouraged to debate ethical issues in class and develop personal views. Professional magazines and trade journals will allow a study of topics currently debated within the industry.

Learners should apply the standards and design principles applicable to interactive multimedia products. Learners should be able to understand the functions and limitations of a range of authoring applications eg interactive multimedia authoring, sound, image and video editing applications.

This unit could be covered later in the programme so that learners may already have developed skills such as sound and video production and will be capable of producing complex and professional looking products. An alternative approach would be to cover the unit at the start of the programme to give a good introduction to each of the interactive multimedia elements that may be taught later. In that case it may be necessary to provide assets (such as sound and video) or to use existing asset libraries to support the learning of the unit.

It is suggested that teaching follows the logical pattern presented in the learning outcomes, with study of principles covered first, followed by development of a learner's own interactive multimedia product ideas, which can be implemented using authoring software and finally published to match a client brief. The concepts of interactive multimedia authoring could be delivered through a mix of lectures, demonstrations, discussions and investigations of existing products. Knowledge could then be applied through a variety of activities and short practical exercises. Learners should have ample opportunities to experiment with and use industry standard software.

Since this unit encourages learners to express imaginative skills, it is appropriate that some critical self-reflective practice is undertaken. This professional skill will encourage a habit of lifelong value in any possible future career. Tutors will need to provide plenty of time for learners to plan and develop graphic specifications, as they will be key to the success of the multimedia project.

### Outline learning plan

The outline learning plan has been included in this unit as guidance and can be used in conjunction with the programme of suggested assignments.

The outline learning plan demonstrates one way in planning the delivery and assessment of this unit.

Topic and suggested assignments/activities and/assessment
<b>Introduction to unit content</b> <ul style="list-style-type: none"> <li>• Understanding the Industry – Technology/Process/Content</li> <li>• Business objectives</li> <li>• Audiences</li> </ul> <p>Mixture of tutor led sessions, research and directed learning.</p>
<b>Assignment 1: criterion P1</b>
<b>Using the software – tools and techniques</b> <ul style="list-style-type: none"> <li>• Combining, editing, manipulating, file formats</li> </ul> <p>Mixture of demonstration, exercises, directed learning over a number of sessions.</p>
<b>Understanding the Project Specification</b> <ul style="list-style-type: none"> <li>• Concept: Audience/Purpose/ Content</li> <li>• Practical considerations: Schedule/Resources</li> <li>• Technical Factors: Schedule/Distribution</li> <li>• Roles &amp; Responsibilities</li> </ul> <p>Mixture of tutor led sessions, research, discussion and directed learning.</p>
<b>Planning a Multimedia Project</b> <ul style="list-style-type: none"> <li>• Stages of design</li> <li>• Design tools</li> <li>• Design documentation</li> <li>• Legal requirements</li> </ul> <p>Mixture of tutor led sessions, research, exercises and directed learning.</p>
<b>Assignment 2: criteria P2, P3, M1</b>

Topic and suggested assignments/activities and/assessment
<b>Testing and reviewing</b> <ul style="list-style-type: none"><li>• Functional testing</li><li>• Gathering and using feedback</li></ul> Exercises, peer group reviews
<b>Presenting</b> <ul style="list-style-type: none"><li>• Display devices, Controls, Settings</li></ul>
<b>Assignment 3: criteria P4, P5, M2, D1</b>

## Assessment

The suggested assessment of this unit is by four assignments as summarised in the Programme of Suggested Assignments (PSA) table below. A specific scenario has been suggested here but any topic providing sufficient scope to cover the assessment criteria may be used to suit particular learners. The tutor could either produce a standard specification for all learners or agree specifications with individual learners that provide sufficient scope to cover all elements of interactive multimedia authoring.

A possible scenario for these assignments could be based on a new enterprise with a retail section considering broadening and improving their current market position. Although they have an informational website, they have not yet developed a facility for mail order or for potential customers to contact them electronically.

For P1, learners must explain how multimedia is used to meet business requirements. This could be evidenced by a presentation with the explanations of the media backed up with examples of different uses in business contexts. Reference should be made to how the media meet the business objectives and are fit for purpose in terms of meeting the needs of the intended audience. A good range of different audience types should be included.

A range of design documentation should be produced as evidence for P2. The documentation should start with an introduction outlining the original business requirement. The design should demonstrate an understanding of the types of content that are possible and when they are appropriate.

For P3, when identifying sources reference should be made to legal requirements.

For M1, there should be a sense of thoughtfulness in the learner's work. For example the storyboards that outline the navigation and content will denote why they have chosen to use particular images, fonts, music etc to engage with their chosen audience and will demonstrate that experimentation and multiple solutions had been produced when considering the organisation and layout of information to be included within their projects. Learners will have shown initiative in determining requirements and trying different approaches and demonstrated imagination in their layouts etc. Although subjective to assess, there should be evidence that learners have gone beyond using standard design elements.

For P4 learners should produce and set up a functional, easy to use multimedia product that is fit for purpose. Learners are expected to be able to use a wide range of tools and techniques as appropriate to the software being used.

P5 requires the product to be set up on different platforms to demonstrate understanding of how this is done. Evidence can be by witness statements, screen shots, printouts etc.

For M2, advanced skills should be demonstrated, appropriate to the software being used, in creating a complex product.

For D1, learners will produce an interactive media product to an agreed specification of technical quality that reflects near-professional standards. They will evidence acquisition of imaginative assets from a variety of conventional and other sources, the assets being well tailored to meet the planned needs of the product. The product will implement the concepts, principles and standards of interactive media authoring with flair. A full range of authoring tools will be used during the production.

Much of the work for assignment 4 will be undertaken as part of the development in assignment 3. It has been separated here simply to reduce the amount of work being submitted at one time. Tutors may split the workload in any way they feel appropriate.

Reviewing for P6 should include feedback from users. Learners should review the responses, determine any changes that could be made and, for M3, adapt their product accordingly. Evidence for M3 should include retesting.

For D2, the final product will have been fully tested and reviewed in the light of user feedback, with all errors detected and either corrected or identified as an area for future development.

### Programme of suggested assignments

The table below shows a programme of suggested assignments that cover the pass, merit and distinction criteria in the assessment and grading grid. This is for guidance and it is recommended that centres either write their own assignments or adapt any Edexcel assignments to meet local needs and resources.

Criteria covered	Assignment title	Scenario	Assessment method
P1	Why multimedia?	You are to give a presentation to a new business explaining how the business could make use of multimedia.	Presentation Handouts
P2, P3, M1	My design is...	The business has asked you to design an interactive website to develop their mail order facility.	Design documentation Presentation Report on legal issues
P4, P5, M2, D1	All singing, all dancing	The design has been approved – now create the site.	Screen shots Annotated printouts etc Witness statement Observation records
P6, M3, D2	Does it work?	Fully test, review and adapt your multimedia product.	Test documentation User reviews Evaluation

## **Links to National Occupational Standards, other BTEC units, other BTEC qualifications and other relevant units and qualifications**

The learning outcomes associated with this unit are closely linked with:

- Unit 22: Developing Computer Games
- Unit 28: Website Production Management
- Unit 30: Digital Graphics and Computers

This unit has links to e-skills UK IT Professional NOS, particularly the areas of competence 4.4 Systems Analysis, 4.7 Systems Design and 5.1 Systems Development.

## **Essential resources**

Learners will need access to computer hardware with appropriate accessories such as scanners and printers, and to appropriate software such as Director, Flash, Dreamweaver, Fireworks, Adobe PhotoShop/Image Ready etc.

## **Employer engagement and vocational contexts**

Within this unit there are opportunities for tutors to support learners with their understanding of the range of hardware and software currently used as industrial standard. Many of these applications and hardware are now accessible to learners. Providing learners with access to relevant software manufacturers' manuals and other textbooks, the internet, and a range of examples of current multimedia practice should be encouraged.

This unit provides learners with the opportunity to gain knowledge of the styles and conventions of vocational areas such as graphic design, photography, post-production and production management.

Learners will have the opportunity to gain a fundamental knowledge of the creative technical and production practices such as understanding target audiences, copyright law, content production, graphic design, photography, typography, videography and moving image. This unit also presents opportunities for learners to understand wider vocational skills such as communication and planning and organisational skills.

Learners should be encouraged to learn and understand the importance of these principles in context with the work of professional practitioners across the creative arts vocational areas. This unit provides scope for learners to be engaged in 'real life' project briefs.

## Indicative reading for learners

### Textbooks

Andrews P – *Adobe PhotoShop Elements 8 for Photographers* (Focal Press, 2009)  
ISBN-10: 0240521897, ISBN-13: 978-0240521893

Chapman Dr.N and Chapman J – *Digital Multimedia* (John Wiley & Sons 2009)  
ISBN-10: 0470512164, ISBN-13: 978-0470512166

Coupland K – *Web Works Navigation* (Rockport Publishers, 2000)

Danielson R – *Navigation (Website Graphics)* (Rockport Publishers, 2000)

Garrand T – *Writing for Multimedia and the Web* (Focal Press, 2002) ISBN-10: 0240803817,  
ISBN-13: 978-0240803814

Gatter M – *Software Essentials for Graphic Designers: Photoshop, Illustrator, InDesign, QuarkXPress, Dreamweaver, Flash and Acrobat* (Laurence King, 2006) ISBN-10: 1856694992,  
ISBN-13: 978-1856694995

Kerman P – *Sams Teach Yourself Macromedia Flash MX in 24 Hours* (Sams, 2003)  
ISBN-10: 0672325942, ISBN-13: 978-0672325946

Microsoft PowerPoint at a Glance (Perspection, 1999)

Sengstack J – *Sams Teach Yourself Adobe Premiere in 24 hours* (Sams, 2002) Windows  
Multimedia Authoring Guide (Microsoft Press International, 1991)

### Journals

Barron A E and Ivers K – *Interactive Media Projects in Education: Designing, Producing and Assessing* (Libraries Unlimited Inc, 2005)

Chapman N and Chapman J – *Digital Interactive Media* (John Wiley & Sons Ltd, 2004)

Fisher S – *Interactive Media Authoring: Building and Developing Documents*  
(Academic Press, 1994)

Harrel W – *The Interactive Media Authoring Workshop* (Sybex International, 1996)

LaBarge R – *DVD Authoring and Production* (Osborne McGraw-Hill, 2001)

Vaughan T – *Interactive Media: Making it Work* (McGraw-Hill Education, 2003)



## Websites

The following websites, correct at time of publication, may be of interest:

[www.collectiveimage.net](http://www.collectiveimage.net)

[www.digit.com](http://www.digit.com)

[www.digitalworkshop.com](http://www.digitalworkshop.com)

Multimedia authoring tools for business

[www.hi-res.net](http://www.hi-res.net)

[www.hyperstudio.com](http://www.hyperstudio.com)

Authoring tools for project-based learning

[www.ingredient.co.uk](http://www.ingredient.co.uk)

[www.macromedia.com](http://www.macromedia.com)

The Adobe website

[www.matchware.net](http://www.matchware.net)

Presentation software developers and suppliers

[www.mccli.dist.maricopa.edu/authoring/lorien.ncl.ac.uk/ming/resources/cal/mmedia.htm](http://www.mccli.dist.maricopa.edu/authoring/lorien.ncl.ac.uk/ming/resources/cal/mmedia.htm)

Directory to sites of interest to those authoring for the web

[www.sixfootsix.co.uk](http://www.sixfootsix.co.uk)

[www.skillset.org](http://www.skillset.org)

[www.state.co.uk](http://www.state.co.uk)

[www.tomatoe.co.uk](http://www.tomatoe.co.uk)

[www.useit.com](http://www.useit.com)

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ISBN 978 1 446 94677 0

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# 1. Introduction

BTEC is one of the world's most successful and best-loved applied learning brands, engaging students in practical, interpersonal and thinking skills for more than thirty years.

BTECs are work-related qualifications for students taking their first steps into employment, or for those already in employment and seeking career development opportunities. BTECs provide progression into the workplace either directly or via study at university and are also designed to meet employer's needs. Therefore, Pearson BTEC Higher National qualifications are widely recognised by industry and higher education as the principal vocational qualification at Levels 4 and 5.

When redeveloping the Pearson BTEC Higher National qualifications in Computing, we collaborated with a wide range of students, employers, higher education providers, colleges and subject experts to ensure that the new qualifications meet their needs and expectations. We also worked closely with the relevant professional bodies, to ensure alignment with recognised professional standards.

There is now a greater emphasis on employer engagement and work readiness. The new Pearson BTEC Higher National qualifications in Computing are designed to reflect this increasing need for high quality professional and technical education pathways at Levels 4 and 5, thereby providing students with a clear line of sight to employment and to progression to a degree at Level 6.

## 1.1 The Student Voice

Students are at the heart of what we do. That is why, from the outset, we consulted with students in the development of these qualifications. We involved them in writing groups, sought their feedback, and added their voices and views to those of other stakeholders.

The result, we believe, are qualifications that will meet the needs and expectations of students worldwide.

## 1.2 Why choose Pearson BTEC Higher Nationals?

Pearson BTEC Higher Nationals are designed to help students secure the knowledge skills and behaviours needed to succeed in the workplace. They represent the latest in professional standards and provide opportunities for students to develop behaviours for work, for example by undertaking a group project, or responding to a client brief. A student may even achieve exemption from professional or vendor qualifications, or student membership of selected professional bodies, to help them on their journey to professional competence.

At the same time the BTEC Higher Nationals are intended to keep doors open for future study should a student wish to progress further in their education after their level 5 study. They do this by allowing space for the development of higher education study skills, such as the ability to research. Clear alignment of level of demand with the Framework for Higher Education qualification descriptors at level 4 and 5 means that students wishing to progress to level 6 study should feel better prepared. The Pearson BTEC Higher Nationals address these various requirements by providing:



- A range of core, optional and specialist units, each with a clear purpose, so there is something to suit each student's choice of programme and future progression plans.
- Fully revised content that is closely aligned with the needs of employers, professional bodies, vendors and higher education for a skilled future workforce.
- Learning Outcomes mapped against Professional Body standards and vendor accreditation requirements, where appropriate.
- Assessments and projects chosen to help students progress to the next stage (this means some are set by the centre to meet local needs, while others are set by Pearson).
- An approach to demand at level 4 and 5 which is aligned with the Framework for Higher Education Qualifications (FHEQ).
- Support for student and tutors including Schemes of Work and Sample Assessment Materials (SAMs).

### 1.3 HN Global

Pearson BTEC Higher Nationals are supported by a specially designed range of digital resources, to ensure that tutors and students have the best possible experience during their course. These are available from the HN Global website <http://www.highernationals.com/>.

With HN Global, tutors can access programme specifications which contain useful information on programme planning and quality assurance processes. Tutors can also view schemes of work and sample assessment materials, helping them create meaningful courses and assessments. HN Global also allows tutors to create and annotate reading lists for their students and also keep up-to-date on the latest news regarding HN programmes.

### 1.4 Qualification titles

#### **Pearson BTEC Level 4 Higher National Certificate in Computing**

#### **Pearson BTEC Level 5 Higher National Diploma in Computing**

Specialist pathways are included within brackets in the qualification title:

- Pearson BTEC Level 5 Higher National Diploma in Computing
- Pearson BTEC Level 5 Higher National Diploma in Computing (Network Engineering)
- Pearson BTEC Level 5 Higher National Diploma in Computing (Software Engineering)
- Pearson BTEC Level 5 Higher National Diploma in Computing (Data Analytics)
- Pearson BTEC Level 5 Higher National Diploma in Computing (Security)
- Pearson BTEC Level 5 Higher National Diploma in Computing (Intelligent Systems)
- Pearson BTEC Level 5 Higher National Diploma in Computing (Applications Development)

## 1.5 Qualification codes

Ofqual Regulated Qualifications Framework (RQF) Qualification numbers:  
Pearson BTEC Level 4 Higher National Certificate in Computing: 603/0472/8  
Pearson BTEC Level 5 Higher National Diploma in Computing: 603/0471/6

## 1.6 Awarding institution

Pearson Education Ltd.

## 1.7 Key features

Pearson BTEC Higher National qualifications in Computing offer:

- A stimulating and challenging programme of study that will be both engaging and memorable for students.
- The essential subject knowledge that students need to progress successfully into further study or the world of work.
- A simplified structure: students undertake a substantial core of learning in the BTEC Higher National Certificate and can build on this in the BTEC Higher National Diploma, with specialist and optional units linked to their area of study.
- Six specialist pathways in the BTEC Level 5 Higher National Diploma, so there is something to suit each student's preference of study and future progression plans.
- Refreshed content that is closely aligned with Professional Body, vendor, employer and higher education needs.
- Assessments that consider cognitive skills (what students know) along with affective and applied skills (how they behave and what they can do, respectively)
- Unit-specific grading and Pearson-set assignments.
- A varied approach to assessment that supports progression to Level 6 and also allows centres to offer assessment relevant to the local economy, thereby accommodating and enhancing different learning styles.
- Quality assurance measures – as outlined in sections 6 and 7 of this Programme Specification – to ensure that all stakeholders (e.g. professional bodies, vendors, universities, businesses, colleges and students) can feel confident in the integrity and value of the qualifications.
- A qualification designed to meet the needs and expectations of students aspiring to work in an international business environment.

### Qualification frameworks

Pearson BTEC Higher National qualifications are designated higher education qualifications in the UK. They are aligned to the Framework for Higher Education Qualifications (FHEQ) in England, Wales and Northern Ireland, and Quality Assurance Agency (QAA) Subject Benchmark Statements. These qualifications are part of the UK Regulated Qualifications Framework (RQF).

## 1.8 Collaborative development

Students completing their Pearson BTEC Higher Nationals in Computing will be aiming to go on to employment or progress to a final year at university. Therefore, it was essential that we developed these qualifications in close collaboration with experts from professional bodies, vendors, businesses and universities, and with the providers who will be delivering the qualifications.

We are very grateful to the university and further education tutors, employers, vendors, Professional Body representatives and other individuals who have generously shared their time and expertise to help us develop these new qualifications.

British Computing Society (BCS)

Institution of Engineering and Technology (IET)

University of Kent

University of Hull

ISC<sup>2</sup>

Uxbridge College

The Tech Partnership

CompTIA

QA Apprenticeships

CISCO

Imago Solutions

National College for Digital Skills

These qualifications have also been approved by the following professional bodies as suitable qualifications for students wanting to gain membership. The professional bodies include:

- The British Computing Society
- The Institution of Engineering and Technology.

## 2. Programme purpose and objectives

### 2.1 Purpose of the Pearson BTEC Higher Nationals in Computing

The purpose of Pearson BTEC Higher Nationals in Computing is to develop students as professional, self-reflecting individuals able to meet the demands of employers in the computing sector and adapt to a constantly changing world. The qualifications aim to widen access to higher education and enhance the career prospects of those who undertake them.

### 2.2 Objectives of the Pearson BTEC Higher Nationals in Computing

The objectives of the Pearson BTEC Higher Nationals in Computing are as follows:

- To equip students with computing skills, knowledge and the understanding necessary to achieve high performance in the global computing environment.
- To provide education and training for a range of careers in computing, including network engineering, software engineering, data analytics, security, intelligent systems, and applications development.
- To provide insight and understanding into international computing operations and the opportunities and challenges presented by a globalised market place.
- To equip students with knowledge and understanding of culturally diverse organisations, cross-cultural issues, diversity and values.
- To provide opportunities for students to enter or progress in employment in computing, or progress to higher education qualifications such as an Honours degree in computing or a related area.
- To provide opportunities for students to develop the skills, techniques and personal attributes essential for successful working lives.
- To provide opportunities for those students with a global outlook to aspire to international career pathways.
- To provide opportunities for students to achieve a nationally recognised professional qualification.
- To provide opportunities for students to achieve vendor accredited certifications.
- To offer students the chance of career progression in their chosen field.
- To allow flexibility of study and to meet local or specialist needs.
- To offer a balance between employability skills and the knowledge essential for students with entrepreneurial, employment or academic aspirations.

We meet these objectives by:

- Providing a thorough grounding in computing principles at Level 4 that leads the student to a range of specialist progression pathways at Level 5 relating to individual professions within the computing sector.

- Enabling progression to a university degree by supporting the development of appropriate academic study skills.
- Enabling progression to further professional qualifications in specific computing areas by mapping to units in a range of vendor accredited certificates.

### **Who is this qualification for?**

The Pearson BTEC Higher National qualifications in Computing are aimed at students wanting to continue their education through applied learning. Pearson BTEC Higher Nationals provide a wide-ranging study of the computing sector and are designed for students who wish to pursue or advance their career in computing. In addition to the knowledge, understanding and skills that underpin the study of the computing sector, Pearson BTEC Higher Nationals in computing give students experience of the breadth and depth of the sector that will prepare them for further study or training.

## **2.3 Aims of the Pearson BTEC Level 4 Higher National Certificate in Computing**

The Pearson BTEC Level 4 Higher National Certificate in Computing offers students a broad introduction to the subject area via a mandatory core of learning, while allowing for the acquisition of skills and experience through the selection of optional units across a range of occupational sectors at Level 4. This effectively builds underpinning core skills while preparing the student for subject specialisation at Level 5. Students will gain a wide range of sector knowledge tied to practical skills gained in research, self-study, directed study and workplace scenarios.

At Level 4 students develop a broad knowledge and awareness of key aspects of the computing sector through six core units, which include one unit assessed by a Pearson-set assignment. The units are:

- Programming
- Networking
- Professional Practice
- Database Design & Development
- Security
- Managing a Successful Computing Project (Pearson-set unit).

The centre can also choose two further optional units at Level 4 from the following:

- Strategic Information Systems
- Computer Systems Architecture
- Software Development Lifecycles
- Website Design & Development
- Maths for Computing
- Data Analytics.

Graduates successfully completing the Pearson BTEC Higher National Certificate in Computing will be able to demonstrate a sound knowledge of the basic concepts of computing. They will be able to communicate accurately and appropriately and they will have the qualities needed for employment that requires some degree of personal responsibility. They will have developed a range of transferable skills to ensure effective team working, independent initiatives, organisational competence and problem-solving strategies. They will be adaptable and flexible in their approach to computing, show resilience under pressure, and meet challenging targets within a given resource.

## **2.4 Aims of the Pearson BTEC Level 5 Higher National Diploma in Computing**

The Pearson BTEC Level 5 Higher National Diploma in Computing offers students six specialist pathways designed to support progression into relevant occupational areas or on to degree-level study. These pathways are linked to Professional Body standards and vendor accredited certification (where appropriate) and can provide professional status and progression to direct employment.

The Pearson BTEC Higher National Diploma offers the following specialist pathways for students who wish to concentrate on a particular aspect of computing:

- Network Engineering
- Software Engineering
- Data Analytics
- Security
- Intelligent Systems
- Applications Development.

There is also a non-specialist 'Computing' pathway, which allows students to complete a Pearson BTEC Higher National Diploma without committing to a particular professional specialism. This offers additional flexibility to providers and students.

Holders of the Pearson BTEC Higher National Diploma will have developed a sound understanding of the principles in their field of study and will have learned to apply those principles more widely. They will have learned to evaluate the appropriateness of different approaches to solving problems. They will be able to perform effectively in their chosen field and will have the qualities necessary for employment in situations requiring the exercise of personal responsibility and decision-making.

## **2.5 Use of Maths and English within the curriculum**

Those working within the computing sector cannot just rely on their technical skills and must ensure **all** skills are relevant to increase employment opportunities. They will be required to communicate appropriately with stakeholders throughout their career and the ability to use maths and English in a professional context is an essential employability skill that must be developed at all levels of study.

Development of essential maths and English skills are embedded throughout these qualifications in accordance with industry requirements and below are some examples of how these skills are developed in the BTEC Higher Nationals Curriculum:

- Written reports
- Formal presentations
- Informal conversations
- Use of professional, sector-specific language
- Using binary data
- Understanding algorithms
- Calculating costs

Some aspects of computing require higher level maths skills than others, but throughout your studies you will be using some level of maths within the curriculum. It is vital that students taking a BTEC Higher National in Computing are aware that these skills will be required throughout their studies, and as part of learning activities and assessments to ensure their skills are in line with current industry standards.

## 2.6 The Skills Framework for the Information Age (SFIA)

The Skills Framework for the Information Age (SFIA) is the global skills and competency framework that describes IT roles and the skills needed for them. It is supported by companies, government and academic institutions worldwide. SFIA describes standard levels of responsibility and accountability used in the framework and are divided according to generic levels of responsibility and skills.

The SFIA Level 3 responsibilities would correlate with those expected from an employer of a HNC graduate.

SFIA levels of responsibility: Level 3

- Autonomy
  - Works under general direction. Uses discretion in identifying and responding to complex issues and assignments. Usually receives specific instructions and has work reviewed at frequent milestones. Determines when issues should be escalated to a higher level.
- Influence
  - Interacts with and influences colleagues. Has working level contact with customers, suppliers and partners. May supervise others or make decisions which impact the work assigned to individuals or phases of projects.
- Complexity
  - Performs a range of work, sometimes complex and non-routine, in a variety of environments.

- Business skills
  - Demonstrates an analytical and systematic approach to issue resolution. Takes the initiative in identifying and negotiating appropriate personal development opportunities. Demonstrates effective communication skills. Contributes fully to the work of teams. Plans, schedules and monitors own work (and that of others where applicable) competently within limited deadlines and according to relevant legislation, standards and procedures. Appreciates the wider business context, and how own role relates to other roles and to the business of the employer or client.

The SFIA Level 4 responsibilities would correlate with those expected from an employer of a HND graduate.

SFIA levels of responsibility: Level 4

- Autonomy
  - Works under general direction within a clear framework of accountability. Exercises substantial personal responsibility and autonomy. Plans own work to meet given objectives and processes.
- Influence
  - Influences customers, suppliers and partners at account level. May have some responsibility for the work of others and for the allocation of resources. Participates in external activities related to own specialism. Makes decisions which influence the success of projects and team objectives.
- Complexity
  - Work includes a broad range of complex technical or professional activities, in a variety of contexts. Investigates, defines and resolves complex issues.
- Business skills
  - Selects appropriately from applicable standards, methods, tools and applications. Communicates fluently, orally and in writing, and can present complex information to both technical and non-technical audiences. Facilitates collaboration between stakeholders who share common objectives. Plans, schedules and monitors work to meet time and quality targets. Rapidly absorbs new information and applies it effectively. Maintains an awareness of developing technologies and their application and takes some responsibility for driving own development.

For full details of the skills covered in each category for SFIA Levels 3 and 4, see *Appendix 3*.

The SFIA framework was used throughout the design and content creation of Pearson BTEC Higher Nationals in Computing.

The National Occupational Standards for IT professionals are industry standards for skills, developed for the Trailblazer Apprenticeships which have been developed in line with the SFIA framework.

CompTIA and BCS have mapped their membership schemes to the SFIA framework.

By using the SFIA framework the Pearson BTEC Higher Nationals in Computing will be aligned with both the Trailblazer Apprenticeships in Digital Industries and Professional Body memberships.



## 2.7 What could these qualifications lead to?

The Pearson BTEC Higher National Certificate provides a solid grounding in computing at Level 4, vendor-accredited certification and Professional Body membership, all of which students can build on should they decide to continue their studies beyond the Certificate stage. The Pearson BTEC Higher National Diploma allows students to specialise by committing to specific career paths and progression routes to degree-level study.

On successful completion of the Pearson BTEC Higher National Diploma at Level 5, students can develop their careers in the computing sector through:

- Entering employment
- Continuing existing employment
- Linking with the appropriate vendor accredited certificates
- Committing to Continuing Professional Development (CPD)
- Progressing to university.

The Level 5 Higher National Diploma is recognised by higher education providers as meeting admission requirements to many relevant computing-related courses.

Details of entry requirements for BTEC Higher National graduates into degree programmes at institutions in the UK and internationally can be found on the Degree Course Finder website (<http://degreecoursefinder.pearson.com/>).

The skills offered as part of the Pearson BTEC Higher National Diploma can provide graduates with the opportunity to work in many different areas of the computing sector. Below are some examples of job roles each qualification could lead to:

Pathway	Job Roles
Network Engineering	Network Engineer Systems Architect Computer Service and Repair Technician Network Manager
Software Engineering	Software Developer Systems Designer Business Analyst Games Developer Web Developer
Data Analytics	Data Analyst Business Analyst Marketing Analyst Data Engineer Fraud Analyst Operation Research Scientist

Pathway	Job Roles
Security	Forensic Computer Analysts IT Security Coordinator Ethical Hacker Fraud Analyst
Intelligent Systems	Software Developer Online Reputation Manager Machine Learning Software Engineer Data Scientist Robotics Engineer
Applications Development	HCI Designer Games Developer Web Developer
General / All Pathways	Systems Analyst Data Designer Systems Tester Database Administrator IT Project Manager IT Support Technician Web Designer

These job roles are based on descriptions from The National Occupational Standards for IT professionals – industry standards for skills, developed in collaboration with employers, professional bodies and others which make it easier for employers to describe job roles, externally and internally. The development of IT Professional Standards was undertaken by The Tech Partnership.

## 2.8 How Pearson BTEC Higher Nationals in Computing provide both transferable employability skills and academic study skills

Students need both relevant qualifications and employability skills to enhance their career prospects and contribute to their personal development. Pearson BTEC Higher National Computing qualifications embed the development of key skills throughout the programme; attributes and strengths required by 21st century employers.

Where employability skills are referred to in this specification, this generally refers to skills in three main categories:

- **Cognitive and problem-solving skills:** critical thinking, approaching non-routine problems by applying expert and creative solutions, use of systems and digital technology, generating and communicating ideas creatively.
- **Intra-personal skills:** self-management, adaptability and resilience, self-monitoring and self-development, self-analysis and reflection, planning and prioritising.
- **Interpersonal skills:** effective communication and articulation of information, working collaboratively, negotiating and influencing, self-presentation.

Pearson Sample Assessment Materials (SAMs) make recommendations for a range of real or simulated assessment activities, for example, group work where appropriate, to encourage development of collaborative and interpersonal skills or a solution-focused case study to provide the opportunity to develop cognitive skills. There are specific requirements for the assessment of these skills, as relevant, within the assessment grids for each unit. SAMs are for guidance and support only and can be customised and amended according to localised needs and requirements. All assignments must still be moderated as per the internal verification process.

Students can also benefit from opportunities for deeper learning, where they are able to make connections between units and select areas of interest for detailed study. In this way Pearson BTEC Higher Nationals provide a vocational context in which students can develop the knowledge and academic study skills required for progression to university degree courses, including:

- Active research skills
- Effective writing skills
- Analytical skills
- Critical thinking
- Creative problem-solving
- Decision-making
- Team building
- Exam preparation skills
- Digital literacy
- Competence in assessment methods used in higher education.

To support you in developing these skills in your students, we have developed a map of higher education relevant transferable and academic study skills, available in appendices.

## 3. Planning your programme

### 3.1 Delivering the Pearson BTEC Higher Nationals in Computing

**You play a central role in helping your students to choose the right Pearson BTEC Higher National qualification.**

Assess your students very carefully to ensure that they take the right qualification and the right pathways or optional units, to allow them to progress to the next stage. You should check the qualification structures and unit combinations carefully when advising students.

You will need to ensure that your students have access to a full range of information, advice and guidance in order to support them in making the necessary qualification and unit choices. When students are recruited, you need to give them accurate information on the title and focus of the qualification for which they are studying.

While there are six named pathways within the Pearson BTEC Higher National Diploma, centres can accommodate other routes through the qualification using the optional units within the pathways.

For example:

- A centre could deliver the Pearson BTEC Level 5 Higher National Diploma in Computing (Applications Development) and choose between 'Unit 31: Games Engine & Scripting', 'Unit 32: Game Design Theory' and 'Unit 47: Games Development' as the two optional units to make up this qualification which would give the student a games computing experience.
- A centre could deliver the Pearson BTEC Level 5 Higher National Diploma in Computing and choose 'Unit 39: E-Commerce & Strategy' as one of the five optional units to make up this qualification which would give the student a business computing experience.

### 3.2 Entry requirements and admissions

Although Pearson do not specify formal entry requirements, as a centre it is your responsibility to ensure that the students you recruit have a reasonable expectation of success on the programme.

For students who have recently been in education, the entry profile is likely to include one of the following:

- A BTEC Level 3 qualification in Computing
- A GCE Advanced Level profile that demonstrates strong performance in a relevant subject or adequate performance in more than one GCE subject. This profile is likely to be supported by GCSE grades at A\* to C (or equivalent)
- Other related Level 3 qualifications
- An Access to Higher Education Certificate awarded by an approved further education institution
- Related work experience
- An international equivalent of the above.

Centres may wish to consider applicants' prior learning when considering their acceptance on a Pearson BTEC Higher Nationals, through Recognition of Prior Learning. (For further information please refer to **Section 8** of this document.)

### English language requirements

Pearson's mission is to help people make more of their lives through learning. In order for students to be successful on Pearson BTEC Higher National qualifications which are **both** taught and assessed in English, it is critical that they have an appropriate level of English language skills.

The following clarifies the requirements for all centres when recruiting applicants on to new Pearson BTEC Higher National qualifications.

All centres delivering the new Pearson BTEC Higher National qualifications must ensure that all students who are non-native English speakers and who have not undertaken their final two years of schooling in English, can demonstrate capability in English at a standard equivalent to the levels identified below, before being recruited to the programme **where the programme is both taught and assessed in English:**

- Common European Framework of Reference (CEFR) level B2
- PTE **51**
- IELTS **5.5**; Reading and Writing must be at **5.5**
- or equivalent.

It is up to the centre to decide what proof will be necessary to evidence individual student proficiency.

The following clarifies the requirements for all centres when recruiting applicants on to new Pearson BTEC Higher National qualifications which are taught in a language other than English, but are assessed in English.

All centres delivering the new Pearson BTEC Higher National qualifications **wholly or partially** in a language other than English, but who are assessed in English, must ensure that all students can demonstrate capability in English at a standard equivalent to the levels identified below, on completion of the programme:

- Common European Framework of Reference (CEFR) level B2
- PTE **51**
- IELTS **5.5**; Reading and Writing must be at **5.5**
- or equivalent.

It is up to the centre to decide what proof will be necessary to evidence individual student proficiency.

### Centre approval

To ensure that centres are ready to assess students and that we can provide the support that is needed all centres must be approved before they can offer these qualifications. For more information about becoming a centre and seeking approval to run our qualifications please visit the support section on our website (<http://qualifications.pearson.com/>).

### **Level of sector knowledge required**

We do not set any requirements for tutors, but we do recommend that centres assess the overall skills and knowledge of the teaching team, which should be relevant, up to date and at the appropriate level.

### **Resources required**

As part of your centre approval, you will need to show that the necessary material resources and work spaces are available to deliver Pearson BTEC Higher Nationals. For some units, specific resources are required, this is clearly indicated in the unit descriptors.

### **HN Global support**

HN Global is an online resource that supports centre planning and delivery of Pearson BTEC Higher Nationals by providing appropriate teaching and learning resources. For further information see sections 5 and 6 of this Programme Specification.

### **Modes of delivery**

Subject to approval by Pearson, centres are free to deliver Pearson BTEC Higher Nationals using modes of delivery that meet the needs of their students. We recommend making use of a wide variety of modes, including:

- Full-time
- Part-time
- Blended learning.

### **Recommendations for employer engagement**

Pearson BTEC Higher Nationals are vocational qualifications and as an approved centre you are encouraged to work with employers on the design, delivery and assessment of the course. This will ensure that students enjoy a programme of study that is engaging and relevant, and which equips them for progression. There are suggestions in section 5.2 about how employers could become involved in delivery and/or assessment, but these are not intended to be exhaustive and there will be other possibilities at a local level.

### **Support from Pearson**

We provide a range of support materials, including Schemes of Work and suggested assignments, with supporting templates. You will be allocated an External Examiner early in the planning stage, to support you with planning your assessments, and there will be training events and support from our Subject Leads.

### **Student employability**

All Pearson BTEC Higher Nationals have been designed and developed with consideration of National Occupational Standards, where relevant, and have been mapped to relevant Professional Body standards and vendor accreditation requirements (see *Appendices 1 & 2*).

Employability skills such as team working and project management as well as practical hands-on skills have been built into the design of the learning aims and content. This gives you the opportunity to use relevant contexts, scenarios and materials to enable students to develop a portfolio of evidence demonstrating the breadth of their skills and knowledge in a way that equips them for employment.

### **3.3 Access to study**

This section focuses on the administrative requirements for delivering a Pearson BTEC Higher National qualification. It will be of value to Quality Nominees, Programme Leaders and Examinations Officers.

Our policy regarding access to our qualifications is that:

- They should be available to everyone who is capable of reaching the required standards.
- They should be free from any barriers that restrict access and progression.

There should be equal opportunities for all those wishing to access the qualifications. We refer Centres to our Pearson Equality and Diversity Policy, which can be found in the support section of our website (<http://qualifications.pearson.com/>).

Centres are required to recruit students to Pearson BTEC Higher National programmes with integrity. They will need to make sure that applicants have relevant information and advice about the qualification, to make sure it meets their needs. Centres should review the applicant's prior qualifications and/or experience to consider whether this profile shows that they have the potential to achieve the qualification. For students with disabilities and specific needs, this review will need to take account of the support available to the student during the teaching and assessment of the qualification. For further guidance and advice please refer to section 9 on reasonable adjustments.

### **3.4 Student registration and entry**

Within 30 days (home students) and 60 days (international students) of enrolment all students should be registered for the qualification, and appropriate arrangements made for internal and external verification. For information on making registrations for the qualification, you will need to refer to the information manual available in the support section of our website (<http://qualifications.pearson.com/>).

Students can be formally assessed only for a qualification on which they are registered. If students' intended qualifications change (for example, if a student decides to choose a different specialist pathway), then the centre must transfer the student to the chosen pathway appropriately. Please note that student work cannot be sampled if the student is not registered or is registered on an incorrect pathway.



### 3.5 Access to assessments

Assessments need to be administered carefully, to ensure that all students are treated fairly, and that results and certification are issued on time, allowing students to move on to chosen progression opportunities.

Our equality policy requires that all students should have equal opportunity to access our qualifications and assessments, and that our qualifications are awarded in a way that is fair to every student. We are committed to making sure that:

- Students with a protected characteristic (as defined in legislation) are not, when they are undertaking one of our qualifications, disadvantaged in comparison to students who do not share that characteristic.
- All students achieve the recognition they deserve for undertaking a qualification and that this achievement can be compared fairly to the achievement of their peers.

Further information on access arrangements can be found on the Joint Council for Qualifications website (<http://www.jcq.org.uk/>).

### 3.6 Administrative arrangements for internal assessment

#### Records

You are required to retain records of assessment for each student. Records should include assessments taken, decisions reached and any adjustments or appeals. Further information on quality and assessment can be found in our UK and international guides available in the support section on our website (<http://qualifications.pearson.com/>). We may ask to audit your records, so they must be retained as specified. All student work must be retained for **a minimum of 12 weeks** after certification has taken place.

#### Reasonable adjustments to assessment

A reasonable adjustment is one that is made before a student takes an assessment, to ensure that he or she has fair access to demonstrate the requirements of the assessments.

You are able to make adjustments to internal assessments to take account of the needs of individual students. In most cases this can be achieved through a defined time extension or by adjusting the format of evidence. We can advise you if you are uncertain as to whether an adjustment is fair and reasonable. You need to plan for time to make adjustments, if necessary.

Further details on how to make adjustments for students with protected characteristics are available on the support section of our website (<http://qualifications.pearson.com/>).

## Special consideration

Special consideration is given after an assessment has taken place for students who have been affected by adverse circumstances, such as illness, and require an adjustment of grade to reflect normal level of attainment. You must operate special consideration in line with Pearson policy (see previous paragraph). You can provide special consideration related to the period of time given for evidence to be provided, or for the format of the assessment (if it is equally valid). You may not substitute alternative forms of evidence to that required in a unit, or omit the application of any assessment criteria to judge attainment. Pearson can consider applications for special consideration in line with the policy, which can be found in the document linked above.

Please note that your centre must have a policy for dealing with mitigating circumstances if students are affected by adverse circumstances, such as illness, which result in non-submission or late submission of assessment.

## Appeals against assessment

Your centre must have a policy for dealing with appeals from students. These appeals may relate to assessment decisions being incorrect or assessment not being conducted fairly. The first step in such a policy could be a consideration of the evidence by a Programme Leader or other member of the programme team. The assessment plan should allow time for potential appeals after assessment decisions have been given to students. If there is an appeal by a student, you must document the appeal and its resolution. Students have a final right of appeal to Pearson, but only if the procedures that you have put in place have been followed. Further details of our policy on enquiries and appeals is available on the support section of our website (<http://qualifications.pearson.com/>).

If your centre is located in England or Wales and the student is still dissatisfied with the final outcome of their appeal s/he can make a further appeal to the Office of the Independent Adjudicator (OIA) by emailing: [enquiries@oiahe.org.uk](mailto:enquiries@oiahe.org.uk). In Northern Ireland a further appeal may be lodged with the Northern Ireland Public Service Ombudsman (NIPSO) by emailing: [nipso@nipso.org.uk](mailto:nipso@nipso.org.uk).

## 3.7 Dealing with malpractice in assessment

'Malpractice' means acts that undermine the integrity and validity of assessment, the certification of qualifications, and/or that may damage the authority of those responsible for delivering the assessment and certification. Malpractice may arise, or be suspected, in relation to any unit or type of assessment within the qualification.

Pearson does not tolerate actions (or attempted actions) of malpractice by students, centre staff or centres in connection with Pearson qualifications. Pearson may impose penalties and/or sanctions on students, centre staff or centres where incidents (or attempted incidents) of malpractice have been proven.

Further details regarding malpractice and advice on preventing malpractice by students, can be found in the support section of our website (<http://qualifications.pearson.com/>).

In the interests of students and centre staff, centres need to respond effectively and openly to all requests relating to an investigation into an incident of suspected malpractice. The procedures we ask you to adopt when tackling malpractice vary between units that are internally assessed and those that are externally assessed.

## **Internally assessed units**

Centres are required to take steps to prevent malpractice and to investigate instances of suspected malpractice. Students must be given information that explains what malpractice is for internal assessment and how suspected incidents will be dealt with by the centre. Full information on dealing with malpractice and plagiarism is available on the support section of our website (<http://qualifications.pearson.com/>). It provides full information on the actions we expect you to take.

Pearson may conduct investigations if it is believed that a centre is failing to conduct internal assessment according to Pearson policies. The above document gives further information, provides examples, and details the penalties and sanctions that may be imposed.

## **Student malpractice**

Heads of centres are required to report incidents of any suspected student malpractice that occur during Pearson external assessments. We ask that centres do so by completing JCO Form M1 from the Joint Council for Qualifications website (<http://www.jcq.org.uk/>) and emailing it, along with any accompanying documents, (signed statements from the student, invigilator, copies of evidence, etc.), to the Investigations Team at [pqsmalpractice@pearson.com](mailto:pqsmalpractice@pearson.com). The responsibility for determining appropriate sanctions or penalties to be imposed on students lies with Pearson.

Students must be informed at the earliest opportunity of the specific allegation and the centre's malpractice policy, including the right of appeal. Students found guilty of malpractice may be disqualified from the qualification for which they have been entered with Pearson.

## **Tutor/centre malpractice**

Heads of centres are required to inform Pearson's Investigations Team of any incident of suspected malpractice by centre staff, before any investigation is undertaken. Heads of centres are requested to inform the Investigations Team by submitting a JCO Form M2b from the Joint Council for Qualifications website (<http://www.jcq.org.uk/>) with supporting documentation to [pqsmalpractice@pearson.com](mailto:pqsmalpractice@pearson.com). Where Pearson receives allegations of malpractice from other sources (for example, Pearson staff or anonymous informants), the Investigations Team will conduct the investigation directly or may ask the head of centre to assist.

Incidents of maladministration (accidental errors in the delivery of Pearson qualifications that may affect the assessment of students) should also be reported to the Investigations Team, using the same method.

Heads of centres/Principals/Chief Executive Officers or their nominees are required to inform students and centre staff suspected of malpractice of their responsibilities and rights; see 6.15 of *JCO Suspected Malpractice in Examinations and Assessments Policies and Procedures* ([www.jcq.org.uk](http://www.jcq.org.uk)).

Pearson reserves the right in cases of suspected malpractice to withhold the issue of results and/or certificates while an investigation is in progress. Depending on the outcome of the investigation, results and/or certificates may be released or withheld. We reserve the right to withhold certification when undertaking investigations, audits and quality assurances processes. You will be notified within a reasonable period of time if this occurs.

## **Sanctions and appeals**

Wherever malpractice is proven, we may impose sanctions or penalties. Where student malpractice is evidenced, penalties may be imposed such as:

- Disqualification from the qualification
- Being barred from registration for Pearson qualifications for a specified period of time.

If we are concerned about your centre's quality procedures, we may impose sanctions such as:

- Working with you to create an improvement action plan
- Requiring staff members to receive further training
- Placing temporary blocks on your certificates
- Placing temporary blocks on registrations of students
- Debarring staff members or the centre from delivering Pearson qualifications
- Suspending or withdrawing centre approval status.

Your centre will be notified if any of these apply.

Pearson has established procedures for centres that are considering appeals against penalties and sanctions arising from malpractice. Appeals against a decision made by Pearson will normally be accepted only from heads of centres (on behalf of students and/or members or staff) and from individual members (in respect of a decision taken against them personally). Further information on appeals can be found in our Enquiries and Appeals Policy available in the support section on our website (<http://qualifications.pearson.com/>).

In the initial stage of any aspect of malpractice, please notify the Investigations Team by email ([pqsmalpractice@pearson.com](mailto:pqsmalpractice@pearson.com)), who will inform you of the next steps.

## 4. Programme structure

### 4.1 Units, credits and Total Qualification Time (TQT)

The Pearson BTEC Higher National Certificate (HNC) is a Level 4 qualification made up of 120 credits. It is usually studied full-time over one year, or part-time over two years.

The Pearson BTEC Higher National Diploma (HND) is a Level 4 and Level 5 qualification made up of 240 credits. It is usually studied full-time over two years, or part-time over four years.

Pearson would expect that a BTEC Higher National Diploma student would have achieved at least 90 credits at Level 4 before progressing to Level 5 units. This allows for the students to submit the remaining 30 credits at Level 4 while undertaking their Level 5 study.

Students undertaking a Pearson BTEC Higher National Diploma who fail to successfully complete the full qualification may be awarded a HNC, if their credit achievement permits.

Pearson BTEC Higher Nationals consist of core units, specialist units and optional units:

- Core are mandatory
- Specialist units are designed to provide a specific occupational focus to the qualification and are aligned to vendor accredited certification
- Required combinations of optional units are clearly set out in the tables below.

All units are usually 15 credits in value, or a multiple thereof. These units have been designed from a learning time perspective, and are expressed in terms of **Unit Learning Hours (ULH)**.

- **Unit Learning Hours (ULH)** represent the total hours that a student needs to achieve the required learning outcomes, for a given *Unit*.
- **Total Qualification Time (TQT)** is an estimate of the total amount of time that could reasonably be expected to be required for a student to achieve and demonstrate the achievement of the level of attainment necessary for the award of a *qualification*.

ULH contribute to the overall Total Qualification Time (TQT). TQT includes undertaking each of the activities of Guided Learning, Directed Learning and Invigilated Assessment. Each 15-credit unit approximates to a 150 Unit Learning Hours (ULH); including 60 hours of Guided Learning.

**Total Qualification Time (TQT) Higher National Certificate (HNC) = 1,200**

**Total Qualification Time (TQT) Higher National Diploma (HND) = 2,400**

Examples of activities which can contribute to Total Qualification Time include:

- Guided Learning
- Independent and unsupervised research/learning
- Unsupervised compilation of a portfolio of work experience
- Unsupervised e-learning
- Unsupervised e-assessment

- Unsupervised coursework
- Watching a pre-recorded podcast or webinar
- Unsupervised work-based learning.

**Guided Learning Hours (GLH)** are defined as the time when a tutor is present to give specific guidance towards the learning aim being studied on a programme. This definition includes lectures, tutorials and supervised study in, for example, open learning centres and learning workshops. Guided Learning includes any supervised assessment activity; this includes invigilated examination and observed assessment and observed work-based practice.

**Total Guided Learning (GL)** Higher National Certificate (HNC) = 480 hours

**Total Guided Learning (GL)** Higher National Diploma (HND) = 960 hours

Some examples of activities which can contribute to Guided Learning include:

- Classroom-based learning supervised by a tutor
- Work-based learning supervised by a tutor
- Live webinar or telephone tutorial with a tutor in real time
- E-learning supervised by a tutor in real time
- All forms of assessment which take place under the immediate guidance or supervision of a tutor or other appropriate provider of education or training, including where the assessment is competency-based and may be turned into a learning opportunity.

## 4.2 Programme structures

The programme structures specify:

- The total credit value of the qualification
- The minimum credit to be achieved at the level of the qualification
- The core units
- The specialist units
- The optional units
- The maximum credit value in units that can be centre commissioned.

When combining units for a Pearson BTEC Higher National qualification, it is the centre's responsibility to make sure that the correct unit combinations are followed.

### Pearson BTEC Level 4 Higher National Certificate in Computing

- 1 Qualification credit value: a minimum of 120 credits. This is made up of eight units, each with a value of 15 credits.
- 2 **Total Qualification Time (TQT)** Higher National Certificate (HNC) = 1,200
- 3 **Total Guided Learning Hours (GLH)** Higher National Certificate (HNC) = 480
- 4 There is a required mix of core, specialist and optional units totalling 120 credits. All units are at Level 4.

- 5 In some cases a maximum of 30 credits can be imported from another RQF Pearson BTEC Higher National qualification and/or from units designed by the centre and approved by Pearson. Core units may **not** be substituted and are **mandatory**. For more information please refer to Higher National Commissioned Qualifications.
- 6 Please note that some specialist units are available as optional units and some optional units are available as specialist units.

<b>Pearson BTEC Level 4 Higher National Certificate in Computing</b>		<b>Unit credit</b>	<b>Level</b>
Core Unit Mandatory	<b>1 Programming</b>	15	4
Core Unit Mandatory	<b>2 Networking</b>	15	4
Core Unit Mandatory	<b>3 Professional Practice</b>	15	4
Core Unit Mandatory	<b>4 Database Design &amp; Development</b>	15	4
Core Unit Mandatory	<b>5 Security</b>	15	4
Core Unit Mandatory	<b>6 Managing a Successful Computing Project (Pearson-set)</b>	15	4
Optional Unit	<b>7 Strategic Information Systems</b>	15	4
Optional Unit	<b>8 Computer Systems Architecture</b>	15	4
Optional Unit	<b>9 Software Development Lifecycles</b>	15	4
Optional Unit	<b>10 Website Design &amp; Development</b>	15	4
Optional Unit	<b>11 Maths for Computing</b>	15	4
Optional Unit	<b>12 Data Analytics</b>	15	4



## Pearson BTEC Level 5 Higher National Diploma in Computing

The Level 5 Higher National Diploma consists of the Level 4 Higher National Certificate (above) plus an additional 120 credits at Level 5 delivered via the general Computing pathway or one of the following six specialist pathways:

- Network Engineering
  - Software Engineering
  - Data Analytics
  - Security
  - Intelligent Systems
  - Applications Development.
- 1 Qualification credit value: a minimum of 240 credits of which 120 credits are at Level 5, and 120 credits are at Level 4 and usually attained via the HNC.
  - 2 **Total Qualification Time (TQT)** Higher National Diploma (HND) = 2,400.
  - 3 **Total Guided Learning Hours (GLH)** Higher National Diploma (HND) = 960.
  - 4 There is a required mix of core, specialist and optional units for each pathway. The core units required for each Level 5 pathway (in addition to the specialist units) are 'Unit 13: Computing Research Project' which is weighted at 30 credits, and 'Unit 14: Business Intelligence', weighted at 15 credits.
  - 5 The requirements of the Higher National Certificate (or equivalent) have to be met. In some cases a maximum of 60 credits can be imported from another RQF Pearson BTEC Higher National qualification and/or from units designed by the centre and approved by Pearson. Core units and specialist units may **not** be substituted.
  - 6 Please note that some specialist units are available as optional units and some optional units are available as specialist units.

The pathways and unit combinations are as follows; for the list of optional units for all pathways at Level 5, please see following pages.

### Combination Rules:

In order to ensure BTEC HND students have the skills required to achieve on specialist pathways we strongly advise that students intending to study the BTEC Higher National Diploma (Network Engineering), BTEC Higher National Diploma (Software Engineering) or the BTEC Higher National Diploma (Data Analytics) also study 'Unit 11: Maths for Computing' at Level 4.

We also advise that students intending to study the BTEC Higher National Diploma (Data Analytics) also study 'Unit 12: Data Analytics' at Level 4.

Students studying on the BTEC Higher National Diploma (Security) are required to study 'Unit 23: Cryptography', before they study 'Unit 25: Information Security Management'.

Pearson BTEC Level 5 Higher National Diploma in Computing		Unit credit	Level
Core units:			
Level 4 units:			
Core Unit Mandatory	<b>1 Programming</b>	15	4
Core Unit Mandatory	<b>2 Networking</b>	15	4
Core Unit Mandatory	<b>3 Professional Practice</b>	15	4
Core Unit Mandatory	<b>4 Database Design &amp; Development</b>	15	4
Core Unit Mandatory	<b>5 Security</b>	15	4
Core Unit Mandatory	<b>6 Managing a Successful Computing Project (Pearson-set)</b>	15	4
Optional Unit	<b>Plus one Optional Level 4 Unit (see below)</b>	15	4
Optional Unit	<b>Plus one Optional Level 4 Unit (see below)</b>	15	4
<b>Level 5 Units:</b> <b>* Please note that centres can choose any of the 5 optional units from the units listed in the optional unit bank. The units have been grouped according to sector specialism for ease of recognition. It is strongly advised to choose one unit from each optional group to deliver a comprehensive general computing qualification.</b>			
Core Unit Mandatory	<b>13 Computing Research Project (Pearson-set)</b>	30	5
Core Unit Mandatory	<b>14 Business Intelligence</b>	15	5

Optional Unit	<b>Plus one Optional unit from any optional group (see below)</b>	15	5
Optional Unit	<b>Plus one Optional unit from any optional group (see below)</b>	15	5
Optional Unit	<b>Plus one Optional unit from any optional group (see below)</b>	15	5
Optional Unit	<b>Plus one Optional unit from any optional group (see below)</b>	15	5
Optional Unit	<b>Plus one Optional unit from any optional group (see below)</b>	15	5
<b>Optional Unit Bank</b>			
<b>Optional Level 4 units:</b>			
Optional Unit	<b>7 Strategic Information Systems</b>	15	4
Optional Unit	<b>8 Computer Systems Architecture</b>	15	4
Optional Unit	<b>9 Software Development Lifecycles</b>	15	4
Optional Unit	<b>10 Website Design &amp; Development</b>	15	4
Optional Unit	<b>11 Maths for Computing</b>	15	4
Optional Unit	<b>12 Data Analytics</b>	15	4
<b>Optional Level 5 units:</b>			
<b>Group A: Network Engineering</b>			
Optional Unit	<b>15 Transport Network Design</b>	15	5
Optional Unit	<b>16 Cloud Computing</b>	15	5
Optional Unit	<b>17 Network Security</b>	15	5

<b>Group B: Software Engineering</b>			
Optional Unit	<b>18 Discrete Maths</b>	15	5
Optional Unit	<b>19 Data Structures &amp; Algorithms</b>	15	5
Optional Unit	<b>20 Advanced Programming</b>	15	5
<b>Group C: Data Analytics</b>			
Optional Unit	<b>18 Discrete Maths</b>	15	5
Optional Unit	<b>21 Data Mining</b>	15	5
Optional Unit	<b>22 Applied Analytical Models</b>	15	5
<b>Group D: Security</b>			
Optional Unit	<b>23 Cryptography</b>	15	5
Optional Unit	<b>24 Forensics</b>	15	5
Optional Unit	<b>25 Information Security Management</b>	15	5
<b>Group E: Intelligent Systems</b>			
Optional Unit	<b>26 Machine Learning</b>	15	5
Optional Unit	<b>27 Artificial Intelligence</b>	15	5
Optional Unit	<b>19 Data Structures &amp; Algorithms</b>	15	5
<b>Group F: Application Development</b>			
Optional Unit	<b>28 Prototyping</b>	15	5
Optional Unit	<b>29 Application Program Interfaces</b>	15	5
Optional Unit	<b>30 Application Development</b>	15	5

<b>Other Optional Units</b>			
Optional Unit	<b>31 Games Engine &amp; Scripting</b>	15	5
Optional Unit	<b>32 Game Design Theory</b>	15	5
Optional Unit	<b>33 Analytical Methods</b>	15	5
Optional Unit	<b>34 Systems Analysis &amp; Design</b>	15	5
Optional Unit	<b>35 Network Management</b>	15	5
Optional Unit	<b>36 Client/Server Computing Systems</b>	15	5
Optional Unit	<b>37 Architecture</b>	15	5
Optional Unit	<b>38 Database Management Systems</b>	15	5
Optional Unit	<b>39 E-Commerce &amp; Strategy</b>	15	5
Optional Unit	<b>40 User Experience &amp; Interface Design</b>	15	5
Optional Unit	<b>41 Analytic Architecture Design</b>	15	5
Optional Unit	<b>42 Risk Analysis &amp; System Testing</b>	15	5
Optional Unit	<b>43 Internet of Things</b>	15	5
Optional Unit	<b>44 Robotics</b>	15	5
Optional Unit	<b>45 Emerging Technologies</b>	15	5
Optional Unit	<b>46 Virtual &amp; Augmented Reality Development</b>	15	5
Optional Unit	<b>47 Games Development</b>	15	5
Optional Unit	<b>48 Systems Integration</b>	15	5
Optional Unit	<b>49 Operating Systems</b>	15	5

Pearson BTEC Level 5 Higher National Diploma in Computing (Network Engineering)		Unit credit	Level
<b>Level 4 units:</b>			
Core Unit Mandatory	<b>1 Programming</b>	15	4
Core Unit Mandatory	<b>2 Networking</b>	15	4
Core Unit Mandatory	<b>3 Professional Practice</b>	15	4
Core Unit Mandatory	<b>4 Database Design &amp; Development</b>	15	4
Core Unit Mandatory	<b>5 Security</b>	15	4
Core Unit Mandatory	<b>6 Managing a Successful Computing Project (Pearson-set)</b>	15	4
Optional Unit	<b>Plus one Optional Level 4 Unit (see below)</b>	15	4
Optional Unit	<b>Plus one Optional Level 4 Unit (see below)</b>	15	4
<b>Level 5 units:</b>			
Core Unit Mandatory	<b>13 Computing Research Project (Pearson-set)</b>	30	5
Core Unit Mandatory	<b>14 Business Intelligence</b>	15	5
Specialist Unit <i>Mandatory</i>	<b>15 Transport Network Design</b>	15	5
Specialist Unit <i>Mandatory</i>	<b>16 Cloud Computing</b>	15	5

Specialist Unit <i>Mandatory</i>	<b>17 Network Security</b>	15	5
Optional Unit	<b>Plus one Optional Level 5 unit (see below)</b>	15	5
Optional Unit	<b>Plus one Optional Level 5 unit (see below)</b>	15	5
<b>Optional Unit Bank</b>			
<b>Optional units Level 4:</b>			
Optional Unit	<b>7 Strategic Information Systems</b>	15	4
Optional Unit	<b>8 Computer Systems Architecture</b>	15	4
Optional Unit	<b>9 Software Development Lifecycles</b>	15	4
Optional Unit	<b>10 Website Design &amp; Development</b>	15	4
Optional Unit	<b>11 Maths for Computing</b>	15	4
Optional Unit	<b>12 Data Analytics</b>	15	4
<b>Optional units Level 5:</b>			
Optional Unit	<b>19 Data Structures &amp; Algorithms</b>	15	5
Optional Unit	<b>20 Advanced Programming</b>	15	5
Optional Unit	<b>21 Data Mining</b>	15	5
Optional Unit	<b>22 Applied Analytical Models</b>	15	5
Optional Unit	<b>23 Cryptography</b>	15	5
Optional Unit	<b>24 Forensics</b>	15	5
Optional Unit	<b>25 Information Security Management</b>	15	5
Optional Unit	<b>27 Artificial Intelligence</b>	15	5
Optional Unit	<b>28 Prototyping</b>	15	5

Optional Unit	<b>29 Application Program Interfaces</b>	15	5
Optional Unit	<b>30 Application Development</b>	15	5
Optional Unit	<b>31 Games Engine &amp; Scripting</b>	15	5
Optional Unit	<b>32 Game Design Theory</b>	15	5
Optional Unit	<b>33 Analytical Methods</b>	15	5
Optional Unit	<b>34 Systems Analysis &amp; Design</b>	15	5
Optional Unit	<b>35 Network Management</b>	15	5
Optional Unit	<b>36 Client/Server Computing Systems</b>	15	5
Optional Unit	<b>37 Architecture</b>	15	5
Optional Unit	<b>38 Database Management Systems</b>	15	5
Optional Unit	<b>39 E-Commerce &amp; Strategy</b>	15	5
Optional Unit	<b>40 User Experience &amp; Interface Design</b>	15	5
Optional Unit	<b>41 Analytic Architecture Design</b>	15	5
Optional Unit	<b>42 Risk Analysis &amp; System Testing</b>	15	5
Optional Unit	<b>43 Internet of Things</b>	15	5
Optional Unit	<b>44 Robotics</b>	15	5
Optional Unit	<b>45 Emerging Technologies</b>	15	5
Optional Unit	<b>46 Virtual &amp; Augmented Reality Development</b>	15	5
Optional Unit	<b>47 Games Development</b>	15	5
Optional Unit	<b>48 Systems Integration</b>	15	5
Optional Unit	<b>49 Operating Systems</b>	15	5



Pearson BTEC Level 5 Higher National Diploma in Computing (Software Engineering)		Unit credit	Level
<b>Level 4 units:</b>			
Core Unit <i>Mandatory</i>	<b>1 Programming</b>	15	4
Core Unit <i>Mandatory</i>	<b>2 Networking</b>	15	4
Core Unit <i>Mandatory</i>	<b>3 Professional Practice</b>	15	4
Core Unit <i>Mandatory</i>	<b>4 Database Design &amp; Development</b>	15	4
Core Unit <i>Mandatory</i>	<b>5 Security</b>	15	4
Core Unit <i>Mandatory</i>	<b>6 Managing a Successful Computing Project (Pearson-set)</b>	15	4
Optional Unit	<b>Plus one Optional Level 4 unit (see below)</b>	15	4
Optional Unit	<b>Plus one Optional Level 4 unit (see below)</b>	15	4
<b>Level 5 units:</b>			
Core Unit <i>Mandatory</i>	<b>13 Computing Research Project (Pearson-set)</b>	30	5
Core Unit <i>Mandatory</i>	<b>14 Business Intelligence</b>	15	5
Specialist Unit <i>Mandatory</i>	<b>18 Discrete Maths</b>	15	5
Specialist Unit <i>Mandatory</i>	<b>19 Data Structures &amp; Algorithms</b>	15	5

Specialist Unit <i>Mandatory</i>	<b>20 Advanced Programming</b>	15	5
Optional Unit	<b>Plus one Optional Level 5 unit (see below)</b>	15	5
Optional Unit	<b>Plus one Optional Level 5 unit (see below)</b>	15	5
<b>Optional Unit Bank</b>			
<b>Optional units Level 4:</b>			
Optional Unit	<b>7 Strategic Information Systems</b>	15	4
Optional Unit	<b>8 Computer Systems Architecture</b>	15	4
Optional Unit	<b>9 Software Development Lifecycles</b>	15	4
Optional Unit	<b>10 Website Design &amp; Development</b>	15	4
Optional Unit	<b>11 Maths for Computing</b>	15	4
Optional Unit	<b>12 Data Analytics</b>	15	4
<b>Optional units Level 5:</b>			
Optional Unit	<b>17 Network Security</b>	15	5
Optional Unit	<b>21 Data Mining</b>	15	5
Optional Unit	<b>22 Applied Analytical Models</b>	15	5
Optional Unit	<b>23 Cryptography</b>	15	5
Optional Unit	<b>24 Forensics</b>	15	5
Optional Unit	<b>25 Information Security Management</b>	15	5
Optional Unit	<b>26 Machine Learning</b>	15	5
Optional Unit	<b>27 Artificial Intelligence</b>	15	5
Optional Unit	<b>28 Prototyping</b>	15	5

Optional Unit	<b>29 Application Program Interfaces</b>	15	5
Optional Unit	<b>30 Application Development</b>	15	5
Optional Unit	<b>31 Games Engine &amp; Scripting</b>	15	5
Optional Unit	<b>32 Game Design Theory</b>	15	5
Optional Unit	<b>34 Systems Analysis &amp; Design</b>	15	5
Optional Unit	<b>35 Network Management</b>	15	5
Optional Unit	<b>36 Client/Server Computing Systems</b>	15	5
Optional Unit	<b>37 Architecture</b>	15	5
Optional Unit	<b>38 Database Management Systems</b>	15	5
Optional Unit	<b>39 E-Commerce &amp; Strategy</b>	15	5
Optional Unit	<b>40 User Experience &amp; Interface Design</b>	15	5
Optional Unit	<b>41 Analytic Architecture Design</b>	15	5
Optional Unit	<b>42 Risk Analysis &amp; System Testing</b>	15	5
Optional Unit	<b>43 Internet of Things</b>	15	5
Optional Unit	<b>44 Robotics</b>	15	5
Optional Unit	<b>45 Emerging Technologies</b>	15	5
Optional Unit	<b>46 Virtual &amp; Augmented Reality Development</b>	15	5
Optional Unit	<b>47 Games Development</b>	15	5
Optional Unit	<b>48 Systems Integration</b>	15	5
Optional Unit	<b>49 Operating Systems</b>	15	5

Pearson BTEC Level 5 Higher National Diploma in Computing (Data Analytics)		Unit credit	Level
<b>Level 4 units:</b>			
Core Unit <i>Mandatory</i>	<b>1 Programming</b>	15	4
Core Unit <i>Mandatory</i>	<b>2 Networking</b>	15	4
Core Unit <i>Mandatory</i>	<b>3 Professional Practice</b>	15	4
Core Unit <i>Mandatory</i>	<b>4 Database Design &amp; Development</b>	15	4
Core Unit <i>Mandatory</i>	<b>5 Security</b>	15	4
Core Unit <i>Mandatory</i>	<b>6 Managing a Successful Computing Project (Pearson-set)</b>	15	4
Optional Unit	<b>Plus one Optional Level 4 unit (see below)</b>	15	4
Optional Unit	<b>Plus one Optional Level 4 unit (see below)</b>	15	4
<b>Level 5 units:</b>			
Core Unit <i>Mandatory</i>	<b>13 Computing Research Project (Pearson-set)</b>	30	5
Core Unit <i>Mandatory</i>	<b>14 Business Intelligence</b>	15	5
Specialist Unit <i>Mandatory</i>	<b>18 Discrete Maths</b>	15	5

Specialist Unit <i>Mandatory</i>	<b>21 Data Mining</b>	15	5
Specialist Unit <i>Mandatory</i>	<b>22 Applied Analytical Models</b>	15	5
Optional Unit	<b>Plus one Optional Level 5 unit (see below)</b>	15	5
Optional Unit	<b>Plus one Optional Level 5 unit (see below)</b>	15	5
<b>Optional Unit Bank</b>			
<b>Optional units Level 4:</b>			
Optional Unit	<b>7 Strategic Information Systems</b>	15	4
Optional Unit	<b>8 Computer Systems Architecture</b>	15	4
Optional Unit	<b>9 Software Development Lifecycles</b>	15	4
Optional Unit	<b>10 Website Design &amp; Development</b>	15	4
Optional Unit	<b>11 Maths for Computing</b>	15	4
Optional Unit	<b>12 Data Analytics</b>	15	4
<b>Optional units Level 5:</b>			
Optional Unit	<b>17 Network Security</b>	15	5
Optional Unit	<b>19 Data Structures &amp; Algorithms</b>	15	5
Optional Unit	<b>20 Advanced Programming</b>	15	5
Optional Unit	<b>23 Cryptography</b>	15	5
Optional Unit	<b>24 Forensics</b>	15	5
Optional Unit	<b>25 Information Security Management</b>	15	5
Optional Unit	<b>26 Machine Learning</b>	15	5

Optional Unit	<b>27 Artificial Intelligence</b>	15	5
Optional Unit	<b>28 Prototyping</b>	15	5
Optional Unit	<b>29 Application Program Interfaces</b>	15	5
Optional Unit	<b>30 Application Development</b>	15	5
Optional Unit	<b>31 Games Engine &amp; Scripting</b>	15	5
Optional Unit	<b>32 Game Design Theory</b>	15	5
Optional Unit	<b>34 Systems Analysis &amp; Design</b>	15	5
Optional Unit	<b>35 Network Management</b>	15	5
Optional Unit	<b>36 Client/Server Computing Systems</b>	15	5
Optional Unit	<b>37 Architecture</b>	15	5
Optional Unit	<b>38 Database Management Systems</b>	15	5
Optional Unit	<b>39 E-Commerce &amp; Strategy</b>	15	5
Optional Unit	<b>40 User Experience &amp; Interface Design</b>	15	5
Optional Unit	<b>41 Analytic Architecture Design</b>	15	5
Optional Unit	<b>42 Risk Analysis &amp; System Testing</b>	15	5
Optional Unit	<b>43 Internet of Things</b>	15	5
Optional Unit	<b>44 Robotics</b>	15	5
Optional Unit	<b>45 Emerging Technologies</b>	15	5
Optional Unit	<b>46 Virtual &amp; Augmented Reality Development</b>	15	5
Optional Unit	<b>47 Games Development</b>	15	5
Optional Unit	<b>48 Systems Integration</b>	15	5
Optional Unit	<b>49 Operating Systems</b>	15	5

Pearson BTEC Level 5 Higher National Diploma in Computing (Security)		Unit credit	Level
<b>Level 4 units:</b>			
Core Unit <i>Mandatory</i>	<b>1 Programming</b>	15	4
Core Unit <i>Mandatory</i>	<b>2 Networking</b>	15	4
Core Unit <i>Mandatory</i>	<b>3 Professional Practice</b>	15	4
Core Unit <i>Mandatory</i>	<b>4 Database Design &amp; Development</b>	15	4
Core Unit <i>Mandatory</i>	<b>5 Security</b>	15	4
Core Unit <i>Mandatory</i>	<b>6 Managing a Successful Computing Project (Pearson-set)</b>	15	4
Optional Unit	<b>Plus one Optional Level 4 unit (see below)</b>	15	4
Optional Unit	<b>Plus one Optional Level 4 unit (see below)</b>	15	4
<b>Level 5 units:</b>			
Core Unit <i>Mandatory</i>	<b>13 Computing Research Project (Pearson-set)</b>	30	5
Core Unit <i>Mandatory</i>	<b>14 Business Intelligence</b>	15	5
Specialist Unit <i>Mandatory</i>	<b>23 Cryptography</b>	15	5
Specialist Unit <i>Mandatory</i>	<b>24 Forensics</b>	15	5

Specialist Unit <i>Mandatory</i>	<b>25 Information Security Management</b>	15	5
Optional Unit	<b>Plus one Optional Level 5 unit (see below)</b>	15	5
Optional Unit	<b>Plus one Optional Level 5 unit (see below)</b>	15	5
<b>Optional Unit Bank</b>			
<b>Optional units Level 4:</b>			
Optional Unit	<b>7 Strategic Information Systems</b>	15	4
Optional Unit	<b>8 Computer Systems Architecture</b>	15	4
Optional Unit	<b>9 Software Development Lifecycles</b>	15	4
Optional Unit	<b>10 Website Design &amp; Development</b>	15	4
Optional Unit	<b>11 Maths for Computing</b>	15	4
Optional Unit	<b>12 Data Analytics</b>	15	4
<b>Optional units Level 5:</b>			
Optional Unit	<b>17 Network Security</b>	15	5
Optional Unit	<b>19 Data Structures &amp; Algorithms</b>	15	5
Optional Unit	<b>20 Advanced Programming</b>	15	5
Optional Unit	<b>21 Data Mining</b>	15	5
Optional Unit	<b>22 Applied Analytical Models</b>	15	5
Optional Unit	<b>26 Machine Learning</b>	15	5
Optional Unit	<b>27 Artificial Intelligence</b>	15	5
Optional Unit	<b>28 Prototyping</b>	15	5
Optional Unit	<b>29 Application Program Interfaces</b>	15	5



Optional Unit	<b>30 Application Development</b>	15	5
Optional Unit	<b>31 Games Engine &amp; Scripting</b>	15	5
Optional Unit	<b>32 Game Design Theory</b>	15	5
Optional Unit	<b>33 Analytical Methods</b>	15	5
Optional Unit	<b>34 Systems Analysis &amp; Design</b>	15	5
Optional Unit	<b>35 Network Management</b>	15	5
Optional Unit	<b>36 Client/Server Computing Systems</b>	15	5
Optional Unit	<b>37 Architecture</b>	15	5
Optional Unit	<b>38 Database Management Systems</b>	15	5
Optional Unit	<b>39 E-Commerce &amp; Strategy</b>	15	5
Optional Unit	<b>40 User Experience &amp; Interface Design</b>	15	5
Optional Unit	<b>41 Analytic Architecture Design</b>	15	5
Optional Unit	<b>42 Risk Analysis &amp; System Testing</b>	15	5
Optional Unit	<b>43 Internet of Things</b>	15	5
Optional Unit	<b>44 Robotics</b>	15	5
Optional Unit	<b>45 Emerging Technologies</b>	15	5
Optional Unit	<b>46 Virtual &amp; Augmented Reality Development</b>	15	5
Optional Unit	<b>47 Games Development</b>	15	5
Optional Unit	<b>48 Systems Integration</b>	15	5
Optional Unit	<b>49 Operating Systems</b>	15	5

Pearson BTEC Level 5 Higher National Diploma in Computing (Intelligent Systems)		Unit credit	Level 4
<b>Level 4 units:</b>			
Core Unit <i>Mandatory</i>	<b>1 Programming</b>	15	4
Core Unit <i>Mandatory</i>	<b>2 Networking</b>	15	4
Core Unit <i>Mandatory</i>	<b>3 Professional Practice</b>	15	4
Core Unit <i>Mandatory</i>	<b>4 Database Design &amp; Development</b>	15	4
Core Unit <i>Mandatory</i>	<b>5 Security</b>	15	4
Core Unit <i>Mandatory</i>	<b>6 Managing a Successful Computing Project (Pearson-set)</b>	15	4
Optional Unit	<b>Plus one Optional Level 4 unit (see below)</b>	15	4
Optional Unit	<b>Plus one Optional Level 4 unit (see below)</b>	15	4
<b>Level 5 units:</b>			
Core Unit <i>Mandatory</i>	<b>13 Computing Research Project (Pearson-set)</b>	30	5
Core Unit <i>Mandatory</i>	<b>14 Business Intelligence</b>	15	5
Specialist Unit <i>Mandatory</i>	<b>19 Data Structures &amp; Algorithms</b>	15	5
Specialist Unit <i>Mandatory</i>	<b>26 Machine Learning</b>	15	5
Specialist Unit <i>Mandatory</i>	<b>27 Artificial Intelligence</b>	15	5

Optional Unit	<b>Plus one Optional Level 5 unit (see below)</b>	15	5
Optional Unit	<b>Plus one Optional Level 5 unit (see below)</b>	15	5
Optional Unit Bank			
<b>Optional units Level 4:</b>			
Optional Unit	<b>7 Strategic Information Systems</b>	15	4
Optional Unit	<b>8 Computer Systems Architecture</b>	15	4
Optional Unit	<b>9 Software Development Lifecycles</b>	15	4
Optional Unit	<b>10 Website Design &amp; Development</b>	15	4
Optional Unit	<b>11 Maths for Computing</b>	15	4
Optional Unit	<b>12 Data Analytics</b>	15	4
<b>Optional units Level 5:</b>			
Optional Unit	<b>17 Network Security</b>	15	5
Optional Unit	<b>18 Discrete Maths</b>	15	5
Optional Unit	<b>20 Advanced Programming</b>	15	5
Optional Unit	<b>21 Data Mining</b>	15	5
Optional Unit	<b>22 Applied Analytical Models</b>	15	5
Optional Unit	<b>23 Cryptography</b>	15	5
Optional Unit	<b>24 Forensics</b>	15	5
Optional Unit	<b>25 Information Security Management</b>	15	5
Optional Unit	<b>28 Prototyping</b>	15	5
Optional Unit	<b>29 Application Program Interfaces</b>	15	5
Optional Unit	<b>30 Application Development</b>	15	5

Optional Unit	<b>31 Games Engine &amp; Scripting</b>	15	5
Optional Unit	<b>32 Game Design Theory</b>	15	5
Optional Unit	<b>34 Systems Analysis &amp; Design</b>	15	5
Optional Unit	<b>35 Network Management</b>	15	5
Optional Unit	<b>36 Client/Server Computing Systems</b>	15	5
Optional Unit	<b>37 Architecture</b>	15	5
Optional Unit	<b>38 Database Management Systems</b>	15	5
Optional Unit	<b>39 E-Commerce &amp; Strategy</b>	15	5
Optional Unit	<b>40 User Experience &amp; Interface Design</b>	15	5
Optional Unit	<b>41 Analytic Architecture Design</b>	15	5
Optional Unit	<b>42 Risk Analysis &amp; System Testing</b>	15	5
Optional Unit	<b>43 Internet of Things</b>	15	5
Optional Unit	<b>44 Robotics</b>	15	5
Optional Unit	<b>45 Emerging Technologies</b>	15	5
Optional Unit	<b>46 Virtual &amp; Augmented Reality Development</b>	15	5
Optional Unit	<b>47 Games Development</b>	15	5
Optional Unit	<b>48 Systems Integration</b>	15	5
Optional Unit	<b>49 Operating Systems</b>	15	5

Pearson BTEC Level 5 Higher National Diploma in Computing (Applications Development)		Unit credit	Level
<b>Level 4 units:</b>			
Core Unit <i>Mandatory</i>	<b>1 Programming</b>	15	4
Core Unit <i>Mandatory</i>	<b>2 Networking</b>	15	4
Core Unit <i>Mandatory</i>	<b>3 Professional Practice</b>	15	4
Core Unit <i>Mandatory</i>	<b>4 Database Design &amp; Development</b>	15	4
Core Unit <i>Mandatory</i>	<b>5 Security</b>	15	4
Core Unit <i>Mandatory</i>	<b>6 Managing a Successful Computing Project (Pearson-set)</b>	15	4
Optional Unit	<b>Plus one Optional Level 4 unit (see below)</b>	15	4
Optional Unit	<b>Plus one Optional Level 4 unit (see below)</b>	15	4
<b>Level 5 units:</b>			
Core Unit <i>Mandatory</i>	<b>13 Computing Research Project (Pearson-set)</b>	30	5
Core Unit <i>Mandatory</i>	<b>14 Business Intelligence</b>	15	5
Specialist Unit <i>Mandatory</i>	<b>28 Prototyping</b>	15	5
Specialist Unit <i>Mandatory</i>	<b>29 Application Program Interfaces</b>	15	5
Specialist Unit <i>Mandatory</i>	<b>30 Application Development</b>	15	5

Optional Unit	<b>Plus one Optional Level 5 unit (see below)</b>	15	5
Optional Unit	<b>Plus one Optional Level 5 unit (see below)</b>	15	5
<b>Optional Unit Bank</b>			
<b>Optional units Level 4:</b>			
Optional Unit	<b>7 Strategic Information Systems</b>	15	4
Optional Unit	<b>8 Computer Systems Architecture</b>	15	4
Optional Unit	<b>9 Software Development Lifecycles</b>	15	4
Optional Unit	<b>10 Website Design &amp; Development</b>	15	4
Optional Unit	<b>11 Maths for Computing</b>	15	4
Optional Unit	<b>12 Data Analytics</b>	15	4
<b>Optional units Level 5:</b>			
Optional Unit	<b>17 Network Security</b>	15	5
Optional Unit	<b>19 Data Structures &amp; Algorithms</b>	15	5
Optional Unit	<b>20 Advanced Programming</b>	15	5
Optional Unit	<b>21 Data Mining</b>	15	5
Optional Unit	<b>22 Applied Analytical Models</b>	15	5
Optional Unit	<b>23 Cryptography</b>	15	5
Optional Unit	<b>24 Forensics</b>	15	5
Optional Unit	<b>25 Information Security Management</b>	15	5
Optional Unit	<b>26 Machine Learning</b>	15	5
Optional Unit	<b>27 Artificial Intelligence</b>	15	5
Optional Unit	<b>31 Games Engine &amp; Scripting</b>	15	5

Optional Unit	<b>32 Game Design Theory</b>	15	5
Optional Unit	<b>33 Analytical Methods</b>	15	5
Optional Unit	<b>34 Systems Analysis &amp; Design</b>	15	5
Optional Unit	<b>35 Network Management</b>	15	5
Optional Unit	<b>36 Client/Server Computing Systems</b>	15	5
Optional Unit	<b>37 Architecture</b>	15	5
Optional Unit	<b>38 Database Management Systems</b>	15	5
Optional Unit	<b>39 E-Commerce &amp; Strategy</b>	15	5
Optional Unit	<b>40 User Experience &amp; Interface Design</b>	15	5
Optional Unit	<b>41 Analytic Architecture Design</b>	15	5
Optional Unit	<b>42 Risk Analysis &amp; System Testing</b>	15	5
Optional Unit	<b>43 Internet of Things</b>	15	5
Optional Unit	<b>44 Robotics</b>	15	5
Optional Unit	<b>45 Emerging Technologies</b>	15	5
Optional Unit	<b>46 Virtual &amp; Augmented Reality Development</b>	15	5
Optional Unit	<b>47 Games Development</b>	15	5
Optional Unit	<b>48 Systems Integration</b>	15	5
Optional Unit	<b>49 Operating Systems</b>	15	5

### **Meeting local needs and centre devised units**

Centres should note that the qualifications set out in these specifications have been developed in consultation with centres, employers, vendors and relevant professional organisations.

The units are designed to meet the skill needs of the sector and the specialist units allow coverage of the full range of employment within the sector. Centres should make maximum use of the choice available to them within the specialist pathways to meet the needs of their students, as well as the local skills and training needs.

Where centres identify a specific need that cannot be addressed using the units in this specification, centres can seek approval from Pearson to use units from other Pearson BTEC Higher National qualifications on the RQF (refer to the website or your Pearson regional contact for application details). Centres will need to justify the need for importing units from other Pearson BTEC Higher National RQF specifications. Meeting local need applications must be made in advance of delivery by 31 January in the year of registration.



The flexibility to import standard units from other BTEC Higher National RQF specifications is **limited to a maximum of 30 credits in a BTEC HNC qualification and a maximum of 60 credits in any BTEC HND qualification**. This is an overall maximum and centres should check the 'Rules of Combination' information for the specific qualification to confirm the actual requirements. These units cannot be used at the expense of the mandatory core units in any qualification nor can the qualification's rules of combination be compromised. The centre must ensure that approved units are used only in eligible combinations.

Alternatively centres can seek approval to use centre-devised units up to the advised maximum amounts for a BTEC HNC or a BTEC HND in the rules of combination to meet a specific need. The centre must provide a clear rationale on the progression benefits to students of taking the unit(s) that they are seeking approval for. Pearson will review the application and confirm or deny the request. The centre-devised units can be authored by the centre, subject to Pearson's scrutiny and approval process. Alternatively the centre may seek design and development of these units by Pearson. It is advisable that applications for approval of centre devised unit(s) are made one year **in advance** of the first year of centre-devised unit(s) delivery, to allow sufficient time for development, review and approval. The centre must not deliver and assess centre-devised units until they have been approved by Pearson.

### 4.3 Pearson-Set Assignments

At both Level 4 and Level 5, as part of the Core units, there are Pearson-set assignments. Each year, Pearson will issue a *Theme* and (for Level 4) a set of related *Topics*. Centres will develop an assignment, to be internally assessed, to engage students in work related to the Pearson-set Theme.

At Level 4, students will select a Topic to further define their approach to the Theme and assignment. At Level 5, it is expected that students will define their own Topic, in negotiation with tutors, based on the Pearson-set Theme.

For example, from the Higher Nationals in Business:

- Theme: "Corporate Social Responsibility (CSR) and its importance for sustainability and competitive advantage"

Level 4 Topics:

- How to start up a socially responsible company
- The impact of CSR on a functional area (e.g. HR, Marketing, Finance) within an organisation to promote profitability and financial sustainability.
- Implementing CSR activities within organisations to meet sustainability objectives.

Centres can find relevant support in the sample assessment material for the units, and the Theme and Topic release documentation, which will be provided for each level.

The aim of the Pearson-set assignments is to provide a common framework for centres to develop work that will allow cross-sector benchmarking, through the standardisation of student work, and identification and sharing of 'best practice' in higher education teaching and learning. Pearson will share the 'best practice' results with all centres. For further information about Pearson-set assignments and assessment, see section 6.0 Assessment of this document.

This is how we refer to the individual units of study that make up a Higher National qualification. Students will study and complete the units included in the programme offered at your centre.

## 4.4 Unit descriptor example

The unit title tells your students what the unit is about - in this case Database Design & Development. At level 4 they can expect to achieve a complete grounding in the subject and the knowledge and skills required to continue their studies in the subject at level 5.

### Unit 4: Database Design & Development

Unit code	H/615/1622
Unit type	Core
Unit level	4
Credit value	15

#### Introduction

Organisations depend on their databases to provide information essential for their day-to-day operations and to help them take advantage of today's rapidly growing and maturing e-commerce opportunities. An understanding of database tools and technologies is an essential skill for designing and developing systems to support them.

Database systems continue to demand more complex data structures and interfaces, as applications get increasingly sophisticated. Most organisations collect and store large volumes of data, either on their own systems or in the cloud, and this data is used not just for the operational running of their business but also mined for other more intelligent and complex applications. Databases stand as the back-end of most systems used by organisations for their operations.

Database design and development is a fundamental and highly beneficial skill for computing students to master, regardless of their specialism.

The aim of this unit is to give students opportunities to develop an understanding of the concepts and issues relating to database design and development, as well as to provide the practical skills to translate that understanding into the design and creation of complex databases.

Topics included in this unit are: examination of different design tools and techniques; examination of different development software options; considering the development features of a fully functional robust solution covering data integrity, data validation, data consistency, data security and advanced database querying facilities across multiple tables; appropriate user interface design for databases and for other externally linked systems; creating complex reports/dashboards, testing the system against the user and system requirements; and elements of complete system documentation.

On successful completion of this unit students will be able to use appropriate tools to design and develop a relational database system for a substantial problem. They will be able to test the system to ensure it meets user and system requirements and fully document the system by providing technical and user documentation. For practical purposes, this unit covers relational databases and related tools and techniques. A brief overview of object-oriented databases will also be covered.

Students will develop skills such as communication literacy, critical thinking, analysis, reasoning and interpretation, which are crucial for gaining employment and developing academic competence.

#### Learning Outcomes

By the end of this unit students will be able to:

- LO1. Use an appropriate design tool to design a relational database system for a substantial problem.
- LO2. Develop a fully functional relational database system, based on an existing system design.
- LO3. Test the system against user and system requirements.
- LO4. Produce technical and user documentation.

All Higher National Certificate units are at level 4. All Higher National Diploma units are at level 5.

The credit value is 15 in most units and 30 in some. To complete a Higher National Certificate or Diploma students are expected to achieve the appropriate number of credits.

Some notes on the unit, giving your students an idea of what they can expect to study, and why the unit is likely to be of interest to them.

There are usually four Learning Outcomes for each unit (and sometimes three). The Learning Outcomes are what students are able to do by the time they complete the unit.

There are three unit types: Core units (which students have to complete to achieve either the Level 4 Certificate or Level 5 Diploma; Specialist units (which students have to complete when studying one of the specialist pathways) and Optional units, which can be chosen. Core units are identified in the unit descriptor, for details of Optional & Specialist units see Section 4.2 'Programme Structures'

This section covers the content that students can expect to study as they work towards achieving their Learning Outcomes.

## **Essential Content**

### **LO1 Use an appropriate design tool to design a relational database system for a substantial problem**

The role of database systems e.g. as back-end systems, in e-commerce, for data mining applications etc.

Determining user and system requirements.

Design tools and techniques for a relational database system.

Logical design for relational databases e.g. tables, data elements, data types, indexes, primary/foreign keys, entity relationship modelling, referential integrity, data normalisation to third normal form.

Designs for data integrity, data validations, data security and data controls.

User interface design.

Output designs for user requirements.

Overview of object-oriented databases and their design tools.

### **LO2 Develop a fully functional relational database system, based on an existing system design**

Consideration of database and platform options for system development.

Examination of different software development options for developing the relational database system.

Implementation of the physical data model based on the logical model.

Data stores, internal storage and external storage (e.g. the cloud).

Implementation of security elements in databases.

Relational databases with controls like data validation using; input masks, drop down lists, option buttons.

User interface for requirements, functionality, reliability, consistency and performance.

Consideration of interface links with other systems e.g. internet-based applications.

Data manipulation using appropriate query tools, including complex queries to query across multiple tables, and using functions and formulae.

Database maintenance and data manipulation: inserts, updates, amendments, deletions, data backup and recovery.

System reports using report writing tools and report generators, dashboards.

### **LO3 Test the system against user and system requirements**

Identify elements of the system that need to be tested.

Consider data that should be used to fully test the system.

Match tests against user and system requirements.

Test procedures to be used: test plans, test models e.g. white box, black box; testing documentation.

Functional and system testing and testing the robustness of the system, including help menus, pop-ups, hot-spots, data validation checks.

### **LO4 Produce technical and user documentation**

Technical and user documentation and their contents.

When assignments are graded the tutor will refer to this table, which connects the unit's Learning Outcomes with the student's work. The assignment may be graded at 'Pass', 'Merit' or 'Distinction' level, depending on the quality of the student's work.

### **Learning Outcomes and Assessment Criteria**

Pass	Merit	Distinction
LO1 Use an appropriate design tool to design a relational database system for a substantial problem		D1 Assess the effectiveness of the design in relation to user and system requirements.
P1 Design a relational database system using appropriate design tools and techniques, containing at least four interrelated tables, with clear statements of user and system requirements.	M1 Produce a comprehensive design for a fully functional system which includes interface and output designs, data validations and data normalisation.	
LO2 Develop a fully functional relational database system, based on an existing system design		LO2 & 3 D2 Evaluate the effectiveness of the database solution in relation to user and system requirements, and suggest improvements.
P2 Develop the database system with evidence of user interface, output and data validations, and querying across multiple tables.	M2 Implement a fully functional database system which includes system security and database maintenance.	
P3 Implement a query language into the relational database system.	M3 Assess whether meaningful data has been extracted through the use of query tools to produce appropriate management information.	
LO3 Test the system against user and system requirements		
P4 Test the system against user and system requirements.	M4 Assess the effectiveness of the testing, including an explanation of the choice of test data used.	
LO4 Produce technical and user documentation		D3 Assess any future improvements that may be required to ensure the continued effectiveness of the database system.
P5 Produce technical and user documentation.	M5 Produce technical and user documentation for a fully functional system, including diagrams showing movement of data through the system, and flowcharts describing how the system works.	



Recommended books, articles and online material that support learning. The programme tutor may suggest alternatives and additions, usually with a local application or relevance.

## **Recommended Resources**

### **Textbooks**

- Churcher, C. (2012) *Beginning Database Design: From Novice to Professional*. 2nd Ed. Apress.
- Connolly, T. and Begg, C. (2014) *Database Systems: A Practical Approach to Design, Implementation and Management*. 6th Ed. Global Edition. Pearson.
- Kroemke, D. and Auer, D. (2012) *Database Concepts: International Edition*. 6th Ed. Pearson.
- Paulraj, P (2008). *Database Design and Development: An Essential Guide for IT Professional*. Wiley.
- Stephens, R. (2008) *Beginning Database Design Solutions*. Wrox.

### **Journals**

- International Journal of Database Management Systems*
- Journal of Database Management*
- The Computer Journal*
- Journal of Systems Analysis and Software Engineering*
- Journal of Emerging Trends in Computing and Information Sciences*

### **Websites**

- |                          |   |
|--------------------------|---|
| www.lynda.com            | Database Training (Tutorials)                               |
| mva.microsoft.com        | Microsoft Virtual Academy "Database Development" (Training) |
| mva.microsoft.com/ebooks | Microsoft Virtual Academy "Microsoft Press" (E-Books)       |

### **Links**

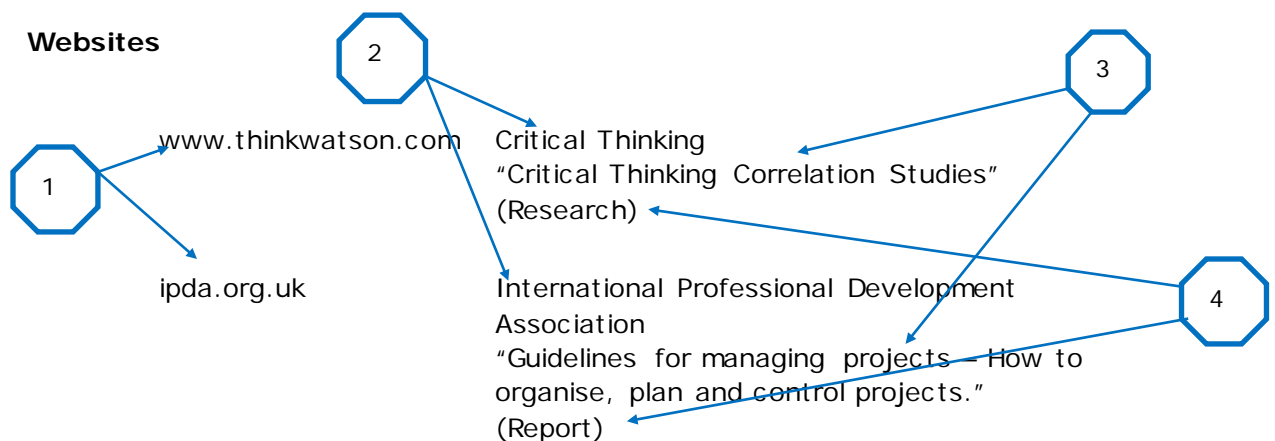
- This unit links to the following related units:
- Unit 7: Strategic Information Systems*
- Unit 38: Database Management Systems*

## Website-based resources – referencing

Some units have website links as part of their recommended resources lists. Hyperlinking to these resources directly can be problematic as locations and addresses of resources can change over time. To combat this we have referenced website-based resources as follows:

- 1 A link to the main page of the website
- 2 The title of the site
- 3 The name of the section or element of the website where the resource can be found
- 4 The type of resource it is. This will be one of the following:
  - o Research
  - o General Reference
  - o Tutorials
  - o Training
  - o E-Books
  - o Report
  - o Wiki
  - o Article
  - o Data sets
  - o Development Tool
  - o Discussion Forum.

Some examples from computing units have been shown below:



## 4.5 Professional Body exemptions

In redeveloping the Pearson BTEC Higher National qualifications in Computing, we have worked closely with the following professional bodies:

- British Computing Society (BCS)
- The Institution of Engineering & Technology (IET).

The BCS represents IT professionals both in the UK and internationally and are a member organisation of CEPIS (Council of European Professional Informatics Societies). The BCS have mapped their membership schemes to the SFIA framework.

With their agreement we have secured exemptions from certain memberships for students achieving Pearson BTEC Higher National qualifications in Computing. Members of the BCS can join various Specialist Groups within the Society. Specialist Groups give BCS members the opportunity to keep up to date on all sector relevant topics. Specialist Group meetings give members the opportunity to complement existing knowledge, contribute towards Continuing Professional Development (CPD), and build exposure to both people in and information on various computing fields. The BCS has 50+ Specialist Groups. Details of BCS membership and Specialist Groups can be found in Appendix 1.

Offering membership to the BCS adds value to the qualification by offering students access to CPD.

## 4.6 Vendor Accreditation

In redeveloping the Pearson BTEC Higher National qualifications in Computing, we have worked closely with vendors to offer students the skills required to gain accredited certifications. Certifications from the following vendors will be available:

- CompTIA
- CISCO
- Microsoft
- Oracle
- AXELOS

Students will not automatically gain vendor accredited certificates as a result of studying a BTEC HNC and/or a BTEC HND.

The skills required to achieve a vendor accredited certificate have been included in specific units (see *Appendix 2* for unit combination details). Once these units have been completed a student can then put themselves forward for vendor accreditation via the vendor-specific route. Details of these routes are available below.

**CompTIA's** vendor-neutral certifications are the starting point for a career in IT. They show employers you have the skills to do the job, regardless of the vendor hardware or software. Earning a CompTIA certification proves you have the right skills, and is the starting place for a career in IT.

- CompTIA A+: validates understanding of the most common hardware and software technologies and certifies the skills necessary to support complex IT infrastructures.
- Network+: validates the essential knowledge and skills needed to confidently design, configure, manage and troubleshoot any wired and wireless networks.
- CompTIA Security+: validates foundational, vendor-neutral IT security knowledge and skills. Covers the essential principles for Network Security and risk management.
- CompTIA Cloud+: validates the skills and expertise of IT practitioners in implementing and maintaining cloud technologies.
- CompTIA Server+: validates planning, securing and maintaining a variety of server equipment.
- CompTIA Linux+: certifies foundational skills and knowledge of Linux.

Details of how to take CompTIA Certification exams can be found on the Pearson Vue website (<http://www.pearsonvue.com/comptia/>).

**CISCO** is the largest networking company in the world and sponsor IT Professional certifications for CISCO products. CISCO Certifications and specialist qualifications are an IT industry standard used to validate knowledge of CISCO products and technologies. Getting certified brings measurable rewards and opens up further professional opportunities.

- CISCO IT Essentials: covers fundamental computer and career skills for entry-level IT jobs.
- CISCO CCNA Routing & Switching: covers knowledge of foundational technologies and skill sets needed for the adoption of next generation networking technologies.
- CISCO CCNA Security: covers skills required to develop a security infrastructure, recognise threats and vulnerabilities to networks, and mitigate security threats.

For students to be in a position to achieve CISCO accredited certification the relevant units must be delivered using CISCO technologies.

Students who study these units with non-CISCO technologies will achieve a BTEC Higher National Diploma, but will not have the skills necessary to take CISCO Certification assessments.

Details of how to take CISCO Certification exams can be found on the Pearson Vue website (<http://www.pearsonvue.com/cisco/>).

**Microsoft Office** is a bundled set of applications which includes Microsoft Word, Microsoft Excel, and Microsoft PowerPoint. A Microsoft Certification validates your expertise in Microsoft technology. Passing your first Microsoft Certification exam automatically makes you a member of the Microsoft Certified Professional (MCP) community, with access to all of the benefits provided through the MCP.

- Microsoft Office Specialist: allows you demonstrate the skills needed to get the most out of Microsoft Office.

Details of how to take the various Microsoft Office exams can be found on the Microsoft learning website (<https://www.microsoft.com/en-us/learning/>).

**Oracle** is a leading database software company and has developed technologies into the entire technology stack. The Oracle Certification Program certifies candidates on skills and knowledge related to Oracle products and technologies.

- Java SE 8 Fundamentals: validates skills in object-oriented programming using the Java language.
- Oracle Database Introduction to SQL: validates skills in the SQL programming language.
- Oracle Database 12c Administration: validates understanding of the Oracle Database architecture.



For students to be in a position to achieve Oracle accredited certification the relevant units must be delivered using Java and/or SQL.

Students who study these units with non-Oracle technologies will achieve a BTEC Higher National Diploma, but will not have the skills necessary to take Oracle's certification assessments.

Details of how to take Oracle Certification exams are available on the Pearson Vue website (<http://www.pearsonvue.com/oracle/>).

**AXELOS** is a joint venture set up by the Government of the UK and Capita, to develop, manage and operate qualifications in best practice methodologies.

- Prince 2 Foundation Qualification: confirms sufficient knowledge and understanding of the PRINCE2 method to be able to work effectively with, or as a member of, a project management team.
- RESILIA Foundation Qualification: verifies understanding of how decisions impact good/bad cyber resilience.

Details of how to take the various exams are available in the links below:

- Prince 2 Foundation (<http://www.axelos.com/certifications/>).
- RESILIA Foundation (<https://www.axelos.com/certifications/>).

See *Appendix 2* for an outline of the unit combinations students must take to be in a position to gain the relevant vendor certifications.

## 5. Teaching and learning

The aim of this section is to provide guidance to centres so that they can engage students in a dynamic, interactive and reflective learning experience. This experience should effectively prepare students to successfully engage in the assessments, which will measure depth, as well as breadth, of knowledge. Teaching should stimulate academic engagement, develop challenging yet constructive discourse and encourage students to reflect on their own performance in preparation for a professional career. Additionally, centres are encouraged to expose students to autonomous and independent learning, which will facilitate the development of their academic skills, experiences and techniques required as they progress from one level of study to the next.

Centres are encouraged to develop programmes that have a distinctive focus on entry into work, delivering a curriculum that embeds employability, has a strong commitment to ethics and diversity, and introduces students to contemporary as well as seminal research. All teaching and learning should reflect the expectations of employers and society, and be informed and guided by external benchmarks such as professional and statutory bodies. In so doing students completing a Pearson BTEC Higher National qualification in Computing will have the attributes, skills, principles and behaviours that will enable them to make a valuable contribution to local, national and international commerce.

The contributions students make to their own experiences, alongside the experience of their peers, is invaluable. Student engagement and the student voice should form a significant aspect of a student's life. Centres are encouraged to gather student opinions on a range of teaching and learning matters, which would be used to inform and enhance future practice within a programme of study and within a centre.

### 5.1 Delivering quality and depth

A high quality teaching and learning experience should include qualified and experienced tutors, an interactive and engaging curriculum, motivated and inspired students, and a support system that caters for the pastoral as well as academic interests of students.

In addition to delivering a quality learning experience, centres must also encourage students to have a deeper understanding of the subject where they are able to go beyond the fundamentals of explaining and describing. Students are expected to show they can analyse data and information, make sense of this and then reach evaluative judgements. At the higher levels of study there is an expectation that students will be able to apply a degree of criticality to their synthesis of knowledge. This criticality would come from exposure to appropriate and relevant theories, concepts and models.

One of the reasons for delivering a quality learning experience, which has depth as well as breadth, is the benchmarking of the qualification to the Framework for Higher Education Qualifications (FHEQ). It also meets requirements set by the Regulated Qualifications Framework (RQF). The first stage of a Pearson BTEC Higher National in Computing is the BTEC Higher National Certificate (HNC), which is aligned with Level 4 of both frameworks; with the BTEC Higher National Diploma (HND) aligned with Level 5. This means that the HNC has the same level of demand and expectations as the first year of a degree programme, with the HND having the same level of demand and expectations as the second year of a degree programme.

Centres are expected to provide a broadly similar experience for students to that which they would have if they attended a similar programme at a university. This could mean:

- Providing access to library facilities which has, as a minimum, available copies (physically and/or electronically) of all required reading material
- Access to research papers and journals
- Utilising a Virtual Learning Environment (VLE) to support teaching and learning
- Working with local employers (see below) to present real-life case studies
- Creating schemes of work that embrace a range of teaching and learning techniques
- Listening to the student voice.

Irrespective of the type of programme on which a student is enrolled, it is highly advisable that students are inducted onto their BTEC Higher National programme. This induction should include an introduction to the course programme and academic study skills that will be essential in supporting their research and studies, and, therefore, enhance the learning experience.

An induction programme should consist of the following:

- Course programme overview
- Preparing for lessons
- Effective engagement in lectures and seminars
- Making the most out of their tutor
- Assignment requirements
- Referencing and plagiarism
- Centre policies
- Academic study skills.

Pearson offer Higher National Global Study Skills to all students– an online toolkit that supports the delivery, assessment and quality assurance of BTECs in centres. This is available on the HN Global website [www.highernationals.com](http://www.highernationals.com). HN Global provides a wealth of support to ensure that tutors and students have the best possible experience during their course. With HN Global, students can converse with other students from around the world, find useful training on how to prepare for their studies and get access to comprehensive online career services.

## 5.2 Engaging with employers

Just as the student voice is important, so too is the employer's. Employers play a significant role in the design and development of all regulated qualifications, including the Pearson BTEC Higher Nationals in Computing. This input should extend into the learning experience, where engagement with employers will add value to students, particularly in transferring theory into practice.

Centres should consider a range of employer engagement activities. These could include:

- Field trips to local businesses
- Inviting members of the local computing community to present guest lectures

- Using employers to judge the quality of assessed presentations and/or products
- Coding Challenges set by local employer.

While detailed guidance on assessment has been provided in this specification (see Section 6), it is worth considering the involvement of employers when determining assessment strategies and the use of different assessment vehicles. This enables centres to design assessments that are more closely related to what students would be doing in the workplace. Employers are able to comment on relevance and content, as well as the challenge presented by an assessment. Notwithstanding this, ultimately it is the centre's responsibility to judge the extent to which any employer contributes to teaching and learning.

### 5.3 Engaging with students

Students are integral to teaching and learning. As such it is important that they are involved as much as possible with most aspects of the programme on to which they are enrolled. This input could include taking into account their views on how teaching and learning will take place, their role in helping to design a curriculum, or on the assessment strategy that will test their knowledge and understanding.

There are many ways in which to capture the student voice and student feedback, both formal and informal. Formal mechanisms include the nomination of student representatives to act as the collective student voice for each student cohort, student representation at course team meetings, and an elected higher education representative as part of the Student Union. Student forums should also take place periodically throughout the year with minutes and action plans updated and informing the overall annual course monitoring process. Unit specific feedback can also be collated by students completing unit feedback forms, end of year course evaluations, and scheduled performance review meetings with their tutor.

However, this should not be the only time when feedback from students is sought. Discourse with students should be constant, whereby teachers adopt a 'reflection on action' approach to adjust teaching, so that students are presented with an environment that is most supportive of their learning needs. Just as employers could have an input into assessment design, so too could students. This will support the development of assignments that are exciting and dynamic, and fully engage students in meaningful and informative assessment.

The biggest advantage of consulting students on their teaching, learning and assessment is securing their engagement in their own learning. Students are likely to feel empowered and develop a sense of ownership of all matters related to teaching, learning and assessment, not just their own experiences. Students could also view themselves as more accountable to their tutors, ideally seeing themselves as partners in their own learning and not just part of a process.

### 5.4 Planning and structuring a programme

Learning should be challenging yet exciting; teaching should be motivating and inspirational. Consequently, both teaching and learning should form part of a programme structure that is active, flexible and progressive, and has an industry focus wherever possible.

It is important for a programme structure to be effectively planned, taking into account the nature of the student cohort, the primary mode of delivery (face-to-face or distance learning) and the level of study. It is also advisable to consider the student voice (whether that voice is heard through end of programme feedback, or through ongoing dialogue) when planning how and when students will be exposed to a particular subject. One other vital source of information that centres would do well to embrace is the feedback from tutors who have been and/or will be delivering learning.

It is recommended that centres establish a programme planning forum where various stakeholders are represented. This forum could consider different perspectives of teaching and learning and how these are planned into an effective programme structure. Consideration could be given to, for example, the holistic and consistent use of Virtual Learning Environments (VLEs), a programme of field trips, a strategy for engaging with employers, and how and when to assess learning.

Consideration should be given to a number of factors when planning a programme structure. These include:

- The sequencing of units
- Whether to have condensed or expanded delivery
- Teaching and learning techniques.

#### **5.4.1 Sequencing units**

The level of demand embedded within a unit is benchmarked to recognised standards. This applies to all units within a level of study, and this means that all Level 4 units have similar demands, as do all Level 5 units. However, this does not mean that units can, or should, be delivered in any order. For example, in the BTEC Higher National Diploma in Computing Level 4 units are delivered, and achieved, by students before progression to Level 5. However, students are able to progress to Level 5 with a minimum of 90 credits at Level 4.

Within each level it is advisable to sequence units so that those providing fundamental knowledge and understanding are scheduled early in the programme. It may also be advisable to schedule the assessment of units requiring the practice and application of more advanced skills later in the programme.

### 5.4.2 Condensed and expanded delivery

The next consideration is whether to deliver a unit in a condensed format alongside other units, or to deliver units over an extended period. The following tables provide examples of this, based on four units being delivered in one teaching block.

Condensed version:

Weeks 1 to 6	Week 7	Weeks 8 to 13	Week 14
Unit 1	Assessment	Unit 3	Assessment
Unit 2		Unit 4	

Expanded version:

Weeks 1 to 12	Weeks 13 and 14
Unit 1	Assessment
Unit 2	
Unit 3	
Unit 4	

The decision to deliver a condensed or expanded programme would depend on a number of factors, including availability of resources, the subjects to be taught and the requirements of students. Both versions have their advantages: the condensed version would provide an opportunity for students to gain early success and achievement. This will enhance their self-efficacy, the sense of one's belief in one's ability to succeed, and self-confidence, with tutors being able to identify and respond to less able students early in the teaching and learning cycle. The advantages of the expanded version include providing a longer timescale for students to absorb new knowledge and therefore, potentially, improve success, and giving tutors an opportunity to coach and support less able students over a longer period of time.

As there are pros and cons to both approaches, the use of a planning forum would help to ensure the most appropriate approach is taken. For example, centres could choose to deliver the first teaching block using the expanded version, with the subsequent teaching block being delivered through a condensed approach.

It should be noted that the above consideration would apply equally to programmes that are being delivered face-to-face or through distance learning.

### 5.4.3 Drawing on a wide range of delivery techniques

As part of planning the range of techniques that will be used to deliver the syllabus, centres should also consider an appropriate combination of techniques for the subject.

The table below lists some of the techniques that centres could introduce into a planned programme structure.

Technique	Face-to-face	Distance learning
Lectures and seminars	These are the most common techniques used by tutors. They offer an opportunity to engage with a large number of students, where the focus is on sharing knowledge through the use of presentations.	Delivery would be through video conferencing and/or pre-recorded audio and/or visual material, available through an online platform. Synchronous discussion forums could also be used.
Workshops	These are used to build on knowledge shared via tutors and seminars. Teaching can be more in-depth where knowledge is applied, for example to case studies or real-life examples. Workshops could be student-led, where students present, for example, findings from independent study.	While more challenging to organise than for face-to-face delivery, workshops should not be dismissed. Smaller groups of three or four students could access a forum simultaneously and engage in the same type of activity as for face-to-face.
Tutorials	These present an opportunity for focused one-to-one support, where teaching is led by an individual student's requirements. These can be most effective in the run up to assessment, where tutors can provide more focused direction, perhaps based on a formative assessment.	Other than not necessarily being in the same room as a student, tutors could still provide effective tutorials. Video conferencing tools provide the means to see a student, which makes any conversation more personal.
Virtual Learning Environments (VLEs)	These are invaluable to students studying on a face-to-face programme. Used effectively, VLEs not only provide a repository for taught material such as presentation slides or hand-outs, but could be used to set formative tasks such as quizzes. Further reading could also be located on a VLE, along with a copy of the programme documents, such as the handbook and assessment timetable.	Where students are engaged with online delivery through distance or blended learning a VLE is a must, as this would be the primary or the key source of learning. Where distance learning is primarily delivered through hard copies of workbooks, etc., the same principle would apply as for face-to-face learning.

Technique	Face-to-face	Distance learning
Blended learning	The combination of traditional face-to-face learning and online learning. This can enable the students to gain personalised support, instruction and guidance while completing assigned activities and tasks remotely.	Offline learning enables students to develop autonomy and self-discipline by completing set activities and tasks with limited direction and traditional classroom-based constraints.
Work-based learning	Any opportunity to integrate work-based learning into a curriculum should be taken. This adds realism and provides students with an opportunity to link theory to practice in a way in which case studies do not. Many full-time students are involved in some form of employment, either paid or voluntary, which could be used, where appropriate, as part of their learning, for example when assignments require students to contextualise a response to a real organisation.	It is likely that the majority of distance learning students would be employed and possibly classed as mature students. Bringing theory to life through a curriculum, which requires work-based application of knowledge, would make learning for these students more relevant and meaningful. Perhaps more importantly, assessment should be grounded in a student's place of work, wherever possible.
Guest speakers	These could be experts from industry or visiting academics in the subject area that is being studied. They could be used to present a lecture/seminar, a workshop or to contribute to assessment. The objective is to make the most effective use of an expert's knowledge and skill by adding value to the teaching and learning experience.	As long as the expert has access to the same platform as the students then the value added contribution would still be very high. Consideration would need to be given to timings and logistics, but with some innovative management this technique would still have a place in distance learning programmes.
Field trips	Effectively planned field trips, which have a direct relevance to the syllabus, will add value to the learning experience. Through these trips students can relate theory to practice, have an opportunity to experience organisations in action, and potentially open their minds to career routes.	The use of field trips can be included as part of a distance learning programme. They will add the same value and require the same planning. One additional benefit of field trips for distance learning is that they provide an opportunity for all students in a cohort to meet, which is a rare occurrence for distance learning students.



#### 5.4.4 Assessment considerations

Centres should design assessment for learning. This is where an assessment strategy requires students to engage with a variety of assessment tools that are accessible, appropriately challenging, and support the development of student self-efficacy and self-confidence. To ensure that assignments are valid and reliable, centres must implement robust quality assurance measures and monitor the effectiveness of their implementation (see Section 6 of this Programme Specification). This includes ensuring that all students engage in assessment positively and honestly.

Assessment also provides a learning opportunity for all stakeholders of the assessment to have access to feedback that is both individual to each student and holistic to the cohort. Feedback to students should be supportive and constructive. Student self-efficacy (and therefore self-confidence) can be significantly enhanced where feedback not only focuses on areas for improvement, but recognises the strengths a student has. At the cohort level, similar trends could be identified that inform future approaches to assessments and teaching. Assessment is an integral part of the overall learning process and assessment strategy must be developed to support effective, reflective, thinking computing practitioners for the future. Assessment can be either formative, summative or both.

#### 5.4.5 Formative assessment

Formative assessment is primarily developmental in nature and designed to give feedback to students on their performance and progress. Assessment designed formatively should develop and consolidate knowledge, understanding, skills and competencies. It is a key part of the learning process and can enhance learning and contribute to raising standards.

Through formative assessment tutors can identify students' differing learning needs early on in the programme and so make timely corrective interventions. Tutors can also reflect on the results of formative assessment to measure how effective the planned teaching and learning is at delivering the syllabus. Each student should receive one set of written formative feedback, otherwise some students may feel that others are being given more than their share of verbal feedback.

#### 5.4.6 Summative assessment

Summative assessment is where students are provided with the assignment grades contributing towards the overall unit grade. For summative assessment to be effective it should also give students additional formative feedback to support ongoing development and improvement in subsequent assignments. All formative assessment feeds directly into the summative assessment for each unit and lays the foundations from which students develop the necessary knowledge and skills required for the summative assessment.

### 5.4.7 Assessment feedback

Effective assessment feedback is part of continuous guided learning which promotes learning and enables improvement. It also allows students to reflect on their performance and helps them understand how to make effective use of feedback. Constructive and useful feedback should enable students to understand the strengths and limitations of their performance, providing positive comments where possible as well as explicit comments on how improvements can be made. Feedback should reflect the Learning Outcomes and marking criteria to also help students understand how these inform the process of judging the overall grade.

The timing of the provision of feedback and of the returned assessed work also contributes to making feedback effective. Specific turnaround time for feedback should be agreed and communicated with both tutors and students. Timing should allow students the opportunity to reflect on the feedback and consider how to make use of it in forthcoming assessments, taking into account the tutor's workload and ability to provide effective feedback.

### 5.4.8 Designing valid and reliable assessments

To help ensure valid and reliable assignments are designed and are consistent across all units, centres could consider a number of actions.

#### *Use of language*

The first aspect of an assignment that a centre could focus on is ensuring that language makes tasks/questions more accessible to students.

Due consideration must be given to the command verbs (i.e. the verbs used in unit assessment criteria) when considering the Learning Outcomes of a unit. Assignments must use appropriate command verbs that equate to the demand of the Learning Outcome. If the outcome requires 'analysis' then 'evaluative' requirements within the assignment must not be set when testing that outcome. This would be viewed as over-assessing. Similarly, it is possible to under-assess where analytical demands are tested using, for example, explanatory command verbs.

The following can be used as a guide to support assignment design:

- Ensure there is a holistic understanding (by tutors and students) and use of command verbs.
- Set assignment briefs that use a single command verb, focusing on the highest level of demand expected for the Learning Outcome(s) that is (are) being tested.
- Assignments should be supported by additional guidance that helps students to interpret the demand of the assessment criteria.
- Time-constrained assessments should utilise the full range of command verbs (or acceptable equivalents) appropriate to the academic level. Modes of time-constrained assessments include in-class tests and exams that could be both open- or closed-book. Centres should pay close consideration to ensuring tests and exams are not replicated during the course of the year.

### *Consistency*

This relates to the consistency of presentation and structure, the consistent use of appropriate assessment language, and the consistent application of grading criteria. Where assignments are consistent, reliability is enhanced. Where validity is present in assignments this will result in assignments that are fit for purpose and provide a fair and equitable opportunity for all students to engage with the assignment requirements.

### *Employing a range of assessment tools*

Just as variation in teaching methods used is important to the planning of a programme structure, so too is the use of a range of assessment tools appropriate to the unit and its content. Centres should consider taking a holistic view of assessment, ensuring a balanced assessment approach with consideration given to the subject being tested and what is in the best interests of students. As mentioned above, consultation with employers could add a sense of realism to an assessment strategy. (A comprehensive list of assessment tools is provided in section 6.2

### *Setting effective assessments.*

No matter what tool is used, assignments should have a sector focus (whether this is in a workplace context or through a case study), and be explicitly clear in its instructions. In the absence of a case study a scenario should be used to provide some context. Finally, students should be clear on the purpose of the assignment and which elements of the unit it is targeting.

## 6. Assessment

BTEC Higher Nationals in Computing are assessed using a combination of internally assessed **centre-devised internal assignments** (which are set and marked by centres) and internally assessed **Pearson-set assignments** (which are set by Pearson and marked by centres). Pearson-set assignments are mandatory and target particular industry-specific skills. The number and value of these units are dependent on qualification size:

- For the HNC
  - one core 15 credit unit at Level 4 will be assessed by a mandatory Pearson-set assignment.
- For the HND
  - two core units: one core 15 credit unit at Level 4 and one core 30 credit unit at Level 5, will be assessed by a mandatory Pearson-set assignment.

All other units in both qualifications are assessed by centre-devised internal assignments.

The purpose and rationale of having Pearson-set units on Higher Nationals is as follows:

- **Standardisation of student work** – Assessing the quality of student work, that it is meeting the level and the requirements of the unit across all centres, that grade decisions and assessor feedback are justified and that internal verification and moderation processes are picking up any discrepancies and issues. The Pearson-set units will be included in the annual sampling of units by the External Examiner.
- **Sharing of good practice** - We will share good practice in relation to themes such as innovative approaches to delivery, the use of digital literacy, enhancement of student employability skills and employer engagement. **These themes will align to those for QAA Higher Education Reviews.**

An appointed External Examiner (EE) for the centre will sample the Pearson-set units as part of the annual Pearson EE centre visit. The focus will be on both standardisation of student assessed work and sharing of good practice with all EE feedback collated and presented in one External Examiner report for each of the units at the end of the year. This will support centres in developing effective assessment strategies, building on good practice and learning from one another.

In developing an overall plan for delivery and assessment for the programme, you will need to consider the order in which you deliver units, whether delivery will take place over short or long periods of time, and when assessment can take place. It is also advisable to plan for the Pearson set units according to the specific unit requirements and the delivery guidance provided in the Sample Assessment Materials.

### Sample Assessment Materials

Each unit has supporting Sample Assessment Materials (SAMs) that are available to download from the course materials section on our website (<http://qualifications.pearson.com/>). The SAMs are there to give you an example of what the assessment will look like in terms of the feel and level of demand of the assessment.

The SAMs, with the exception of the mandatory Pearson-set unit, provide tutors with suggested types of assignment and structure that can be adopted or adapted accordingly.

## 6.1 Principles of internal assessment

This section gives an overview of the key features of internal assessment and how you, as an approved centre, can offer it effectively. The full requirements and operational information are given in the Pearson Quality Assurance Handbook available in the support section of our website (<http://qualifications.pearson.com/>). All the assessment team will need to refer to this document.

For Pearson BTEC Higher Nationals it is important that you can meet the expectations of stakeholders and the needs of students by providing a programme that is practical and applied. Centres can tailor programmes to meet local needs and should use links with local employers and the wider computing sector.

When internal assessment is operated effectively it is challenging, engaging, practical and up to date. It must also be fair to all students and meet national standards.

### Assessment through assignments

For internally assessed units the format of assessment is an assignment taken after the content of the unit, or part of the unit if several assignments are used, has been fully delivered. An assignment may take a variety of forms, including practical and written types. An assignment is a distinct activity completed independently by students (either alone or in a team). An assignment is separate from teaching, practice, exploration and other activities that students complete with direction from and, formative assessment by, tutors.

An assignment is issued to students as an **assignment brief** with a hand-out date, a completion date and clear requirements for the evidence that students are expected to provide. There may be specific observed practical components during the assignment period. Assignments can be divided into separate parts and may require several forms of evidence. A valid assignment will enable a clear and formal assessment outcome based on the assessment criteria.

### Assessment decisions through applying unit-based criteria

Assessment decisions for Pearson BTEC Higher Nationals are based on the specific criteria given in each unit and set at each grade level. The criteria for each unit have been defined according to a framework to ensure that standards are consistent in the qualification and across the suite as a whole. The way in which individual units are written provides a balance of assessment of understanding, practical skills and vocational attributes appropriate to the purpose of the qualifications.

The assessment criteria for a unit are hierarchical and holistic. For example, if an M criterion requires the student to show 'analysis' and the related P criterion requires the student to 'explain', then to satisfy the M criterion a student will need to cover both 'explain' and 'analyse'. The unit assessment grid shows the relationships among the criteria so that assessors can apply all the criteria to the student's evidence at the same time. In *Appendix 5* we have set out a definition of terms that assessors need to understand.

Assessors must show how they have reached their decisions using the criteria in the assessment records. When a student has completed all the assessment for a unit then the assessment team will give a grade for the unit. This is given simply according to the highest level for which the student is judged to have met all the criteria. Therefore:

- **To achieve a Pass**, a student must have satisfied all the Pass criteria for the Learning Outcomes, showing coverage of the unit content and therefore attainment at Level 4 or 5 of the national framework.
- **To achieve a Merit**, a student must have satisfied all the Merit criteria (and therefore the Pass criteria) through high performance in each Learning Outcome.
- **To achieve a Distinction**, a student must have satisfied all the Distinction criteria (and therefore the Pass and Merit criteria), and these define outstanding performance across the unit as a whole.

The award of a Pass is a defined level of performance and cannot be given solely on the basis of a student completing assignments. Students who do not satisfy the Pass criteria should be reported as Unclassified.

### The assessment team

It is important that there is an effective team for internal assessment. There are three key roles involved in implementing assessment processes in your centre, each with different interrelated responsibilities, and these roles are listed below. Full information is given in the Pearson Quality Assurance Handbook available in the support section of our website (<http://qualifications.pearson.com/>).

- **The Programme Leader** has overall responsibility for the programme, its assessment and internal verification to meet our requirements, record keeping and liaison with the External Examiner. The Programme Leader registers with Pearson annually and acts as an assessor, supports the rest of the assessment team, makes sure they have the information they need about our assessment requirements, and organises training, making use of our guidance and support materials.
- **Internal Verifiers** (IVs) oversee all assessment activity in consultation with the Programme Leader. They check that assignments and assessment decisions are valid and that they meet our requirements. IVs will be standardised by working with the Programme Leader. Normally, IVs are also assessors, but they do not verify their own assessments.
- **Assessors** set or use assignments to assess students to national standards. Before taking any assessment decisions, assessors participate in standardisation activities led by the Programme Leader. They work with the Programme Leader and IVs to ensure that the assessment is planned and carried out in line with our requirements.
- Your **External Examiner** (EE) will sample student work across assessors. Your EE will also want to see evidence of informal verification of assignments and assess decisions.

## Effective organisation

Internal assessment needs to be well organised so that student progress can be tracked and so that we can monitor that assessment is being carried out in line with national standards. We support you in this through, for example, providing training materials and sample documentation. Our online HN Global service can also help support you in planning and record keeping.

It is particularly important that you manage the overall assignment programme and deadlines to make sure that all your students are able to complete assignments on time.

## Student preparation

To ensure that you provide effective assessment for your students, you need to make sure that they understand their responsibilities for assessment and the centre's arrangements. From induction onwards you will want to ensure that students are motivated to work consistently and independently to achieve the requirements of the qualifications. They need to understand how assignments are used, the importance of meeting assignment deadlines, and that all the work submitted for assessment must be their own.

You will need to give your students a guide that explains:

- How assignments are used for assessment
- How assignments relate to the teaching programme
- How students should use and reference source materials, including what would constitute plagiarism.

The guide should also set out your centre's approach to operating assessments, such as how students must submit assignments/work and the consequences of submitting late work and the procedure for requesting extensions for mitigating circumstances.

## 6.2 Setting effective assessments

### Setting the number and structure of assessments

In setting your assessments you need to work with the structure of assessments shown in the relevant section of a unit. This shows the learning aims and outcomes and the criteria that you are expected to follow.

Pearson provide online Sample Assessment Materials (SAMs) for each unit to support you in developing and designing your own assessments.

In designing your own assignment briefs you should bear in mind the following points:

- The number of assignments for a unit must not exceed the number of Learning Outcomes listed in the unit descriptor. However, you may choose to combine assignments, either to cover a number of Learning Outcomes or to create a single assignment for the entire unit.

- You may also choose to combine all or parts of different units into single assignments, provided that all units and all their associated Learning Outcomes are fully addressed in the programme overall. If you choose to take this approach you need to make sure that students are fully prepared, so that they can provide all the required evidence for assessment, and that you are able to track achievement in assessment records.
- A learning outcome must always be assessed as a whole and must not be split into two or more elements.
- The assignment must be targeted to the Learning Outcomes but the Learning Outcomes and their associated criteria are not tasks in themselves. Criteria are expressed in terms of the outcome shown in the evidence.

You do not have to follow the order of the Learning Outcomes of a unit in setting assignments, but later Learning Outcomes often require students to apply the content of earlier Learning Outcomes, and they may require students to draw their learning together.

Assignments must be structured to allow students to demonstrate the full range of achievement at all grade levels. Students need to be treated fairly by being given the opportunity to achieve a higher grade, if they have the ability.

As assignments provide a final assessment, they will draw on the specified range of teaching content for the Learning Outcomes. **The specified unit content must be taught/delivered.** The evidence for assessment need not cover every aspect of the teaching content, as students will normally be given particular examples, case studies or contexts in their assignments. For example, if a student is carrying out one practical performance, or an investigation of one organisation, then they will address all the relevant range of content that applies in that instance.

### Providing an assignment brief

A good assignment brief is one that, through providing challenging and authentic sector/work-related tasks, motivates students to provide appropriate evidence of what they have learnt.

An assignment brief should have:

- A vocational scenario: this could be a simple situation or a full, detailed set of vocational requirements that motivates the student to apply their learning through the assignment.
- Clear instructions to the student about what they are required to do, normally set out through a series of tasks.
- An audience or purpose for which the evidence is being provided.
- An explanation of how the assignment relates to the unit(s) being assessed.

### Forms of evidence

Pearson BTEC Higher Nationals have always allowed for a variety of forms of assessment evidence to be used, provided they are suited to the type of Learning Outcomes being assessed. For many units, the practical demonstration of skills is necessary and, for others, students will need to carry out their own research and analysis, working independently or as part of a team.



The SAMs give you information on what would be suitable forms of evidence to give students the opportunity to apply a range of employability or transferable skills. Centres may choose to use different suitable forms of evidence to those proposed. Overall, students should be assessed using varied forms of evidence.

These are some of the main types of assessment:

- Written reports, essays
- In-class tests
- Examinations
- Creation of design documents
- Creation of implementation documents
- Work-based projects
- Academic posters, displays, leaflets
- PowerPoint (or similar) presentations
- Recordings of interviews/role plays
- Working logbooks, reflective journals
- Presentations with assessor questioning
- Time-constrained assessment.

(Full definitions of different types of assessment are given in *Appendix 6*.) The form(s) of evidence selected must:

- Allow the student to provide all the evidence required for the Learning Outcomes and the associated assessment criteria at all grade levels.
- Allow the student to produce evidence that is their own independent work.
- Allow a verifier to independently reassess the student to check the assessor's decisions.

For example, when you are using performance evidence, you need to think about how supporting evidence can be captured through recordings, photographs or task sheets.

Centres need to take particular care that students are enabled to produce independent work. For example, if students are asked to use real examples, then best practice would be to encourage them to use examples of their own or to give the group a number of examples that can be used in varied combinations.

## 6.3 Making valid assessment decisions

### Authenticity of student work

An assessor must assess only student work that is authentic, i.e. the student's own independent work. Students must authenticate the evidence that they provide for assessment through signing a declaration stating that it is their own work. A student declaration must state that:

- Evidence submitted for the assignment is the student's own
- The student understands that false declaration is a form of malpractice.

Assessors must ensure that evidence is authentic to a student through setting valid assignments and supervising them during the assessment period. Assessors must also take care not to provide direct input, instructions or specific feedback that may compromise authenticity.

Centres may use Pearson templates or their own templates to document authentication.

During assessment an assessor may suspect that some or all of the evidence from a student is not authentic. The assessor must then take appropriate action using the centre's policies for malpractice. (See section 3.7 in this Programme Specification for further information.)

### **Making assessment decisions using criteria**

Assessors make judgements using the criteria. The evidence from a student can be judged using all the relevant criteria at the same time. The assessor needs to make a judgement against each criterion that evidence is present and sufficiently comprehensive. For example, the inclusion of a concluding section may be insufficient to satisfy a criterion requiring 'evaluation'.

Assessors should use the following information and support in reaching assessment decisions:

- The explanation of key terms in *Appendix 5* of this document
- Examples of moderated assessed work
- Your Programme Leader and assessment team's collective experience supported by the standardisation materials we provide.

### **Dealing with late completion of assignments**

Students must have a clear understanding of the centre's policy on completing assignments by the deadlines that you give them. Students may be given authorised extensions for legitimate reasons, such as illness, at the time of submission, in line with your centre policies (and please also refer to section 3.6 in this Programme Specification).

For assessment to be fair, it is important that students are all assessed in the same way and that some students are not advantaged by having additional time or the opportunity to learn from others. Therefore, it may be advisable that students who do not complete assignments by your planned deadline should not have the opportunity to subsequently resubmit. Centres should develop and publish their own regulations on late submission. However, if you accept a late completion by a student, then the assignment should be assessed normally when it is submitted, using the relevant assessment criteria.

### **Issuing assessment decisions and feedback**

Once the assessment team has completed the assessment process for an assignment, the outcome is a formal assessment decision. This is recorded formally and reported to students. The information given to the student:

- Must show the formal decision and how it has been reached, indicating how or where criteria have been met.
- May show why attainment against criteria has not been demonstrated.
- Must not provide feedback on how to improve evidence but how to improve in the future.

## Resubmission opportunity

An assignment provides the final assessment for the relevant Learning Outcomes and is normally a final assessment decision. A student who, for the first assessment opportunity, has failed to achieve a Pass for that unit specification **shall be expected to undertake a reassessment**.

- Only one opportunity for reassessment of the unit will be permitted.
- Reassessment for course work, project- or portfolio-based assessments shall normally involve the reworking of the original task.
- For examinations, reassessment shall involve completion of a new task.
- A student who undertakes a reassessment will have their grade capped at a Pass for that unit.
- A student will not be entitled to be reassessed in any component of assessment for which a Pass grade or higher has already been awarded.

## Repeat units

A student who, for the first assessment opportunity and resubmission opportunity, still failed to achieve a Pass for that unit specification:

- At Centre discretion and Assessment Board, decisions can be made to permit a repeat of a unit
- The student must study the unit again with full attendance and payment of the unit fee
- The overall unit grade for a successfully completed repeat unit is capped at a Pass for that unit
- Units can only be repeated once.

## Assessment Boards

Each centre is expected by Pearson to hold Assessment Boards for all of its Pearson BTEC Higher National programmes. The main purpose of an Assessment Board is to make recommendations on:

- The grades achieved by students on the individual units
- Extenuating circumstances
- Cases of cheating and plagiarism
- Progression of students on to the next stage of the programme
- The awards to be made to students
- Referrals and deferrals.

Assessment Boards may also monitor academic standards. The main boards are normally held at the end of the session, although if your centre operates on a semester system there may be (intermediate) boards at the end of the first semester. There may also be separate boards to deal with referrals.

Where a centre does not currently have such a process then the External Examiner (EE) should discuss this with the Quality Nominee and Programme Leader, stressing the requirement for Assessment Boards by both Pearson and QAA and that Assessment Board reports and minutes provide valuable evidence for QAA's Review of College Higher Education process

## 6.4 Planning and record keeping

For internal processes to be effective, an assessment team needs to be well organised and keep effective records. The centre will also work closely with us so that we can quality assure that national standards are being satisfied. This process gives stakeholder's confidence in the assessment approach.

The Programme Leader must have an assessment plan, produced as a spreadsheet. When producing a plan the assessment team will wish to consider:

- The time required for training and standardisation of the assessment team.
- The time available to undertake teaching and carrying out of assessment, taking account of when students may complete external assessments and when quality assurance will take place.
- The completion dates for different assignments.
- Who is acting as Internal Verifier (IV) for each assignment and the date by which the assignment needs to be verified.
- Setting an approach to sampling assessor decisions though internal verification that covers all assignments, assessors and a range of students.
- How to manage the assessment and verification of students' work, so that they can be given formal decisions promptly.
- How resubmission opportunities can be scheduled.

The Programme Leader will also maintain records of assessment undertaken. The key records are:

- Verification of assignment briefs
- Student authentication declarations
- Assessor decisions on assignments, with feedback given to students
- Verification of assessment decisions.

Examples of records and further information are available in the Pearson Quality Assurance Handbook available in the support section of our website (<http://qualifications.pearson.com>).

## 6.5 Calculation of the final qualification grade

### Conditions for the Award

To achieve a Pearson BTEC Higher National Diploma qualification a student must have:

- completed units equivalent to 120 credits at Level 5;
- achieved at least a Pass in 105 credits at Level 5;
- completed units equivalent to 120 credits at Level 4;
- achieved at least a Pass in 105 credits at Level 4.

To achieve a Pearson BTEC Higher National Certificate qualification a student must have:

- completed units equivalent to 120 credits at Level 4;
- achieved at least a Pass in 105 credits at Level 4.

## Compensation Provisions

### Compensation Provisions for the Pearson BTEC Higher National Diploma

A student can still be awarded a HND if they have not achieved a minimum of a Pass in one of the 15 credit units at Level 4 and one of the 15 credit units at Level 5 but they have otherwise fulfilled all the above conditions.

### Compensation Provisions for the Pearson BTEC Higher National Certificate

A student can still be awarded an HNC if they have not achieved a minimum of a Pass in one of the 15 credit units but they have otherwise fulfilled all the above conditions.

The calculation of the **overall qualification grade** is based on the student's performance in all units to the value of 120 credits. Students are awarded a Pass, Merit or Distinction qualification grade using the points gained through all 120 credits, at Level 4 for the HNC or Level 5 for the HND, based on unit achievement.

- All units in valid combination must be attempted (120 credits)
- At least 105 credits must be Pass or above
- All 120 credits count in calculating the grade
- The overall qualification grade is calculated in the same way for the HNC and for the HND
- The overall qualification grade for the HND will be calculated based on student performance in Level 5 units only.

Points per credit:

Pass: 4

Merit: 6

Distinction: 8

### Point boundaries

Grade	Point boundaries
Pass	420–599
Merit	600–839
Distinction	840 +

## Modelled Student Outcomes

**Pearson BTEC Level 4 Higher National Certificate**

				STUDENT 1		STUDENT 2		STUDENT 3		STUDENT 4		STUDENT 5	
	Credits	Level	Grade	Grade point	Unit points	Grade	Unit points	Grade	Unit points	Grade	Unit points	Grade	Unit points
Core 1	15	4	P	4	60	P	60	P	60	D	120	D	120
Core 2	15	4	P	4	60	P	60	P	60	D	120	M	90
Core 3	15	4	P	4	60	P	60	P	60	D	120	M	90
Core 4	15	4	P	4	60	P	60	M	90	M	90	M	90
Core 5	15	4	M	6	90	P	60	M	90	M	90	M	90
Core 6	15	4	M	6	90	P	60	M	90	M	90	M	90
Opt 1	15	4	M	6	90	M	90	D	120	D	120	D	120
Opt 2	15	4	M	6	90	M	90	D	120	D	120	D	120
TOTAL					600		540		690		870		810
GRADE					M		P		M		D		M

### Pearson BTEC Level 5 Higher National Diploma

				STUDENT 1		STUDENT 2		STUDENT 3		STUDENT 4		STUDENT 5	
	Credits	Level	Grade	Grade point	Unit points	Grade	Unit points	Grade	Unit points	Grade	Unit points	Grade	Unit points
Core 1	15	4	P	0	0	P	0	P	0	D	0	P	0
Core 2	15	4	P	0	0	P	0	P	0	D	0	M	0
Core 3	15	4	P	0	0	P	0	P	0	D	0	M	0
Core 4	15	4	P	0	0	P	0	M	0	M	0	M	0
Core 5	15	4	M	0	0	P	0	M	0	M	0	P	0
Core 6	15	4	M	0	0	P	0	M	0	D	0	U	0
Opt 1	15	4	M	0	0	P	0	D	0	D	0	D	0
Opt 2	15	4	M	0	0	P	0	D	0	D	0	D	0
Core 7	30	5	M	6	180	M	180	M	180	P	120	D	240
Core 8	15	5	M	6	90	M	90	M	90	P	60	D	120
Opt 3	15	5	M	6	90	M	90	D	120	P	60	D	120
Opt 4	15	5	M	6	90	P	60	D	120	P	60	D	120
Opt 5	15	5	M	6	90	P	60	D	120	M	90	M	90
Opt 6	15	5	M	6	90	P	60	M	90	M	90	P	60
Opt 7	15	5			90	P	60	M	90	M	90	M	90
TOTAL	240				720		600		810		570		840
GRADE					M		M		M		P		D

## 7. Quality assurance

Pearson's quality assurance system for all Pearson BTEC Higher National programmes is benchmarked to Level 4 and Level 5 on the Quality Assurance Agency (QAA) Framework for Higher Education Qualifications (FHEQ). This will ensure that centres have effective quality assurance processes to review programme delivery. It will also ensure that the outcomes of assessment are to national standards.

The quality assurance process for centres offering Pearson BTEC Higher National programmes comprise five key components:

- 1 The approval process
- 2 Monitoring of internal centre systems
- 3 Independent assessment review
- 4 Annual programme monitoring report
- 5 Annual student survey.

### 7.1 The approval process

Centres new to the delivery of Pearson programmes will be required to seek approval initially through the existing centre approval process and then through the programme approval process. Programme approval for new centres can be considered in one of two ways:

- Desk-based approval review
- Review and approval visit to the centre.

Prior to approval being given, centres will be required to submit evidence to demonstrate that they:

- Have the human and physical resources required for effective delivery and assessment.
- Understand the implications for independent assessment and agree to abide by these.
- Have a robust internal assessment system supported by 'fit for purpose' assessment documentation.
- Have a system to internally verify assessment decisions, to ensure standardised assessment decisions are made across all assessors and sites.

Applications for approval must be supported by the head of the centre (Principal or Chief Executive, etc.) and include a declaration that the centre will operate the programmes strictly, as approved and in line with Pearson requirements.

Centres seeking to renew their programme approval upon expiry of their current approval period may be eligible for the Automatic Approval process, subject to the centre meeting the eligibility criteria set out by Pearson.

Regardless of the type of centre, Pearson reserves the right to withdraw either qualification or centre approval when it deems there is an irreversible breakdown in the centre's ability either to quality assure its programme delivery or its assessment standards.



## 7.2 Monitoring of internal centre systems

Centres will be required to demonstrate ongoing fulfilment of the centre approval criteria over time and across all Higher National programmes. The process that assures this is external examination, which is undertaken by External Examiners. Centres will be given the opportunity to present evidence of the ongoing suitability and deployment of their systems to carry out the required functions. This includes the consistent application of policies affecting student registrations, appeals, effective internal examination and standardisation processes. Where appropriate, centres may present evidence of their operation within a recognised code of practice, such as that of the Quality Assurance Agency for Higher Education. Pearson reserves the right to confirm independently that these arrangements are operating to Pearson's standards.

Pearson will affirm, or not, the ongoing effectiveness of such systems. Where system failures are identified, sanctions (appropriate to the nature of the problem) will be applied, in order to assist the centre in correcting the problem.

## 7.3 Independent assessment review

The internal assessment outcomes reached for all Pearson BTEC Higher National programmes benchmarked to Level 4 and Level 5 of the Quality Assurance Agency (QAA) Framework for Higher Education Qualifications (FHEQ), are subject to a visit from a Pearson appointed External Examiner. The outcomes of this process will be:

- To confirm that internal assessment is to national standards and allow certification, **or**
- To make recommendations to improve the quality of assessment outcomes before certification is released, **or**
- To make recommendations about the centre's ability to continue to be approved for the Pearson BTEC Higher National qualifications in question.

## 7.4 Annual Programme Monitoring Report (APMR)

The APMR is a written annual review form that provides opportunity for centres to analyse and reflect on the most recent teaching year. By working in collaboration with centres, the information can be used by Pearson to further enhance the quality assurance of the Pearson BTEC Higher National programmes.

## 7.5 Annual student survey

Pearson will conduct an annual survey of Pearson BTEC Higher National students. The purpose of the survey is to enable Pearson to evaluate the student experience as part of the quality assurance process, by engaging with students studying on these programmes.

## 7.6 Centre and qualification approval

As part of the approval process, your centre must make sure that the resource requirements listed below are in place before offering the qualification.

Centres must have appropriate physical resources (for example equipment, IT, learning materials, teaching rooms) to support the delivery and assessment of the qualifications.

- Staff involved in the assessment process must have relevant expertise and/or occupational experience.
- There must be systems in place to ensure continuing professional development for staff delivering the qualification.
- Centres must have in place appropriate health and safety policies relating to the use of equipment by staff and students.
- Centres must deliver the qualification in accordance with current equality legislation.
- Centres should refer to the individual unit descriptors to check for any specific resources required.

## 7.7 Continuing quality assurance and standards verification

We produce annually the latest version of the **Pearson Quality Handbook**. It contains detailed guidance on the quality processes required to underpin robust assessment and internal verification.

The key principles of quality assurance are that:

- A centre delivering Pearson BTEC Higher National programmes must be an approved centre, and must have approval for the programmes or groups of programmes that it is delivering.
- The centre agrees, as part of gaining approval, to abide by specific terms and conditions around the effective delivery and quality assurance of assessment; it must abide by these conditions throughout the period of delivery.
- Pearson makes available to approved centres a range of materials and opportunities through online standardisation; these are intended to exemplify the processes required for effective assessment and provide examples of effective standards. Approved centres must use the materials and services to ensure that all staff delivering BTEC qualifications keep up to date with the guidance on assessment.
- An approved centre must follow agreed protocols for standardisation of assessors and verifiers, for the planning, monitoring and recording of assessment processes, and for dealing with special circumstances, appeals and malpractice.

The approach of quality-assured assessment is through a partnership between an approved centre and Pearson. We will make sure that each centre follows best practice and employs appropriate technology to support quality-assurance processes where practicable. We work to support centres and seek to make sure that our quality-assurance processes do not place undue bureaucratic processes on centres. We monitor and support centres in the effective operation of assessment and quality assurance.

The methods we use to do this for Pearson BTEC Higher Nationals include:

- Making sure that all centres complete appropriate declarations at the time of approval
- Undertaking approval visits to centres
- Making sure that centres have effective teams of assessors and verifiers who are trained to undertake assessment
- Assessment sampling and verification through requested samples of assessments, completed assessed student work and associated documentation
- An overarching review and assessment of a centre's strategy for assessing and quality-assuring its BTEC programmes.

An approved centre must make certification claims only when authorised by us and strictly in accordance with requirements for reporting. Centres that do not fully address and maintain rigorous approaches to quality assurance cannot seek certification for individual programmes or for all Pearson BTEC Higher National qualifications.

Centres that do not comply with remedial action plans may have their approval to deliver qualifications removed.

## 8. Recognition of Prior Learning and attainment

Recognition of Prior Learning (RPL) is a method of assessment (leading to the award of credit) that considers whether students can demonstrate that they can meet the assessment requirements for a unit through knowledge, understanding or skills they already possess, and so do not need to develop through a course of learning.

Pearson encourages centres to recognise students' previous achievements and experiences whether at work, home or at leisure, as well as in the classroom. RPL provides a route for the recognition of the achievements resulting from continuous learning. RPL enables recognition of achievement from a range of activities using any valid assessment methodology. Provided that the assessment requirements of a given unit or qualification have been met, the use of RPL is acceptable for accrediting a unit, units or a whole qualification. Evidence of learning must be valid and reliable.

For full guidance on RPL please refer to the Recognition of Prior Learning policy document available in the support section of our website (<https://qualifications.pearson.com>).

## 9. Equality and diversity

Equality and fairness are central to our work. The design of these qualifications embeds consideration of equality and diversity as set out in the qualification regulators' General Conditions of Recognition. Promoting equality and diversity involves treating everyone with equal dignity and worth, while also raising aspirations and supporting achievement for people with diverse requirements, entitlements and backgrounds. An inclusive environment for learning anticipates the varied requirements of students, and aims to ensure that all students have equal access to educational opportunities. Equality of opportunity involves enabling access for people who have differing individual requirements as well as eliminating arbitrary and unnecessary barriers to learning. In addition, students with and without disabilities are offered learning opportunities that are equally accessible to them, by means of inclusive qualification design.

Pearson's equality policy requires all students to have equal opportunity to access our qualifications and assessments. It also requires our qualifications to be designed and awarded in a way that is fair to every student. We are committed to making sure that:

- Students with a protected characteristic (as defined in legislation) are not, when they are undertaking one of our qualifications, disadvantaged in comparison to students who do not share that characteristic.
- All students achieve the recognition they deserve from undertaking a qualification and that this achievement can be compared fairly to the achievement of their peers.

Pearson's policy regarding access to its qualifications is that:

- They should be available to everyone who is capable of reaching the required standards
- They should be free from any barriers that restrict access and progression
- There should be equal opportunities for all those wishing to access the qualifications.

Centres are required to recruit students to Higher National qualifications with integrity. This will include ensuring that applicants have appropriate information and advice about the qualifications, and that the qualification will meet their needs. Centres will need to review the entry profile of qualifications and/or experience held by applicants, considering whether this profile shows an ability to progress to a higher level qualification. Centres should take appropriate steps to assess each applicant's potential and make a professional judgement about their ability to successfully complete the programme of study and achieve the qualification. This assessment will need to take account of the support available to the student within the centre during their programme of study and any specific support that might be necessary to allow the student to access the assessment for the qualification. Centres should consult our policy documents on students with particular requirements.

### **Access to qualifications for students with disabilities or specific needs**

Students taking a qualification may be assessed in British Sign Language or Irish Sign Language, where it is permitted for the purpose of reasonable adjustments. Further information on access arrangements can be found in the Joint Council for Qualifications (JCQ) document *Access Arrangements, Reasonable Adjustments and Special Consideration for General and Vocational Qualifications*. Details on how to make adjustments for students with protected characteristics are given in the document *Pearson Supplementary Guidance for Reasonable Adjustment and Special Consideration in Vocational Internally Assessed Units*. See the support section our website for both documents (<http://qualifications.pearson.com/>).

## **10. Pearson BTEC Higher Nationals Computing Units**

# Unit 1: Programming

**Unit code** D/615/1618

**Unit type** Core

**Unit level** 4

**Credit value** 15

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## Introduction

Programming involves describing processes and procedures which are derived from algorithms. The ability to program is what sets apart a developer and an end user. Typically the role of the developer is to instruct a device (such as a computer) to carry out instructions; the instructions are known as source code and is written in a language that is converted into something the device can understand. The device executes the instructions it is given.

Algorithms help to describe the solution to a problem or task; by identifying the data and the process needed to represent the problem or task *and* the set of steps needed to produce the desired result.

Programming languages typically provide the representation of both the data and the process; they provide control constructs and data types (which can be numbers, words, and objects, and be constant or variable).

The control constructs are used to represent the steps of an algorithm in a convenient yet unambiguous fashion. Algorithms require constructs that can perform sequential processing, selection for decision-making, and iteration for repetitive control. Any programming language that provides these basic features can be used for algorithm representation.

This unit introduces students to the core concepts of programming with an introduction to algorithms and the characteristics of programming paradigms.

Among the topics included in this unit are: introduction to algorithms, procedural, object-orientated & event-driven programming, security considerations, the integrated development environment and the debugging process.

On successful completion of this unit students will be able to design and implement algorithms in a chosen language within a suitable Integrated Development Environment (IDE). This IDE will be used to develop and help track any issues with the code.

As a result they will develop skills such as communication literacy, critical thinking, analysis, reasoning and interpretation which are crucial for gaining employment and developing academic competence.



## Learning Outcomes

By the end of this unit students will be able to:

- LO1. Define basic algorithms to carry out an operation and outline the process of programming an application.
- LO2. Explain the characteristics of procedural, object-orientated and event-driven programming, conduct an analysis of a suitable Integrated Development Environment (IDE).
- LO3. Implement basic algorithms in code using an IDE.
- LO4. Determine the debugging process and explain the importance of a coding standard.

## Essential Content

### **LO1 Define basic algorithms to carry out an operation and outline the process of programming an application**

*Algorithm definition:*

Writing algorithms to carry out an operation, e.g. Bubble sort.

The relationship between algorithms and code.

The generation process of code; the roles of the pre-processor, compiler and linker, interpreter.

### **LO2 Explain the characteristics of procedural, object-orientated and event-driven programming. Conduct an analysis of a suitable Integrated Development Environment (IDE)**

*Characteristics of code:*

Definitions of: data types (the role of constants/variables), methods (including input/output), control structures, iteration, scope, parameter passing, classes, inheritance and events.

Key components of an IDE with a brief explanation each component.

### **LO3 Implement basic algorithms in code using an IDE**

*Implementation:*

Developing simple applications which implements basic algorithms covered in LO1, using the features of a suitable language and IDE. Consider possible security concerns and how these could be solved.

### **LO4 Determine the debugging process and explain the importance of a coding standard**

*Review and reflection:*

Documentation of the debugging process in the IDE, with reference to watch lists, breakpoints and tracing.

How the debugging process can be used to help developers fix vulnerabilities, defects and bugs in their code.

What a coding standard is and its benefits when writing code.

## Learning Outcomes and Assessment Criteria

Pass		Merit	Distinction
<b>LO1</b> Define basic algorithms to carry out an operation and outline the process of programming an application			<b>D1</b> Examine the implementation of an algorithm in a suitable language. Evaluate the relationship between the written algorithm and the code variant.
<b>P1</b> Provide a definition of what an algorithm is and outline the process in building an application.	<b>M1</b> Determine the steps taken from writing code to execution.		
<b>LO2</b> Explain the characteristics of procedural, object-orientated and event-driven programming, conduct an analysis of a suitable Integrated Development Environment (IDE)			<b>D2</b> Critically evaluate the source code of an application which implements the programming paradigms, in terms of the code structure and characteristics.
<b>P2</b> Give explanations of what procedural, object-orientated and event-driven paradigms are; their characteristics and the relationship between them.	<b>M2</b> Analyse the common features that a developer has access to in an IDE.		
<b>LO3</b> Implement basic algorithms in code using an IDE			<b>D3</b> Evaluate the use of an IDE for development of applications contrasted with not using an IDE.
<b>P3</b> Write a program that implements an algorithm using an IDE.	<b>M3</b> Use the IDE to manage the development process of the program.		
<b>LO4</b> Determine the debugging process and explain the importance of a coding standard			<b>D4</b> Critically evaluate why a coding standard is necessary in a team as well as for the individual.
<b>P4</b> Explain the debugging process and explain the debugging facilities available in the IDE. <b>P5</b> Outline the coding standard you have used in your code.	<b>M4</b> Evaluate how the debugging process can be used to help develop more secure, robust applications.		

## Recommended Resources

This unit does not specify which programme language should be used to deliver this content – this decision can be made by the tutor.

Examples of languages that are used in industry are C#, Python, Ruby, Java, but any language which will allow the student to achieve the Learning Outcomes is acceptable.

## Textbooks

AHO, A. V. et al. (1987) *Data Structures and Algorithms*. 1st Ed. Addison-Wesley.

HUNT, A. et al. (2000) *The Pragmatic Programmer: From Journeyman to Master*. 1st Ed. Addison-Wesley.

MCCONNELL, S. (2004) *Code Complete: A Practical Handbook of Software Construction*. 2nd Ed. Microsoft Press.

## Links

This unit links to the following related units:

*Unit 19: Data Structures & Algorithms*

*Unit 20: Advanced Programming*

*Unit 28: Prototyping*

# Unit 2: Networking

<b>Unit code</b>	<b>H/615/1619</b>
<b>Unit type</b>	<b>Core</b>
<b>Unit level</b>	<b>4</b>
<b>Credit value</b>	<b>15</b>

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## Introduction

Computer networks are the driving force behind the evolution of computer systems and allow users to access data, hardware and services regardless of their location. Being knowledgeable about the underlying principles of networking is of vital importance to all IT professionals. Networking is an environment that is increasingly complex and under continuous development.

Complex computer networking has connected the world by groups of small networks through internet links to support global communications. It supports access to digital information anytime, anywhere using many applications like e-mail, audio and video transmission, including the World Wide Web, and this has opened the floodgates to the availability of information.

The aim of this unit is to provide students with wider background knowledge of computer networking essentials, how they operate, protocols, standards, security considerations and the prototypes associated with a range of networking technologies.

Students will explore a range of hardware, with related software, and will configure and install these to gain knowledge of networking systems. A range of networking technologies will be explored to deliver a fundamental knowledge of Local Area Networking (LAN), Wide Area Networking (WAN) and their evolution to form large-scale networks and the protocol methodologies related to IP data networks will be explored.

On successful completion of this unit students will gain knowledge and skills to successfully install, operate and troubleshoot a small network; and the operation of IP data networks, router, switching technologies, IP routing technologies, IP services and basic troubleshooting. Supporting a range of units in the Higher National suite, this unit underpins the principles of networks for all and enables students to work towards their studies in vendor units, if applicable.

Students will develop skills such as communication literacy, critical thinking, analysis, reasoning and interpretation, which are crucial for gaining employment and developing academic competence.

## **Learning Outcomes**

By the end of this unit students will be able to:

- LO1. Examine networking principles and their protocols.
- LO2. Explain networking devices and operations.
- LO3. Design efficient networked systems.
- LO4. Implement and diagnose networked systems.

## Essential Content

### L01 Examine networking principles and their protocols

#### *Role of networks:*

Purpose, benefits, resource implications, communications, working practice, commercial opportunity, information sharing, collaboration.

#### *System types:*

Peer-based, client-server, cloud, cluster, centralised, virtualised.

#### *Networking standards:*

Conceptual models e.g. OSI model, TCP/IP model; standards: e.g. IEEE 802.x.

#### *Topology:*

Logical e.g. Ethernet, Token Ring; physical e.g. star, ring, bus, mesh, tree, ring.

#### *Protocols:*

Purpose of protocols; routed protocols e.g. IPv4, IPv6, IPv6 addressing, Global unicast, Multicast, Link local, Unique local, EUI 64, Auto configuration, FTP, HTTP, SMTP, POP3, SSL; management of protocols for addressing.

### L02 Explain networking devices and operations

#### *Networking devices:*

Servers; hub, routers; switches; multilayer switch, firewall, HIDS, repeaters; bridges; wireless devices; access point (wireless/wired), content filter, Load balancer, Modem, Packet shaper, VPN concentrator.

#### *Networking software:*

Client software, server software, client operating system, server operating system, Firewall.

#### *Server type:*

Web, file, database, combination, virtualisation, terminal services server.

#### *Server selection:*

Cost, purpose, operating system requirement.

#### *Workstation:*

Hardware e.g. network card, cabling; permissions; system bus; local-system architecture e.g. memory, processor, I/O devices.

### **L03 Design efficient networked systems**

#### *Bandwidth:*

Expected average load; anticipated peak load; local internet availability; cost constraints, throughput.

#### *Users:*

Quality expectations, concept of system growth.

#### *Networking services and applications:*

DHCP; static vs dynamic IP addressing, reservations, scopes, leases, options (DNS servers, Suffixes), IP helper, DHCP relay, DNS records, Dynamic DNS.

#### *Communications:*

Suited to devices, suited to users, supportive of lifestyle desires, supportive of commercial requirements, security requirements, quality of service needs.

#### *Scalable:*

Able to support device growth, able to support addition of communication devices, able to cope with bandwidth use and trend changes, protocol utilisation, addressing.

#### *Selection of components:*

Supporting infrastructure needs; supporting connectivity requirements.

### **L04 Implement and diagnose networked systems**

#### *Devices:*

Installation of communication devices, allocation of addresses, local client configuration, server configuration, server installation, security considerations.

#### *Verification of configuration and connectivity:*

Installation of internet work communication medium, ping, extended ping, traceroute, telnet, SSH.

#### *System monitoring:*

Utilisation, bandwidth needs, monitoring user productivity and security of the system.

#### *Maintenance schedule:*

Backups, upgrades, security, auditing.

#### *Diagnose and resolve layer 1 problems:*

Framing, CRC, Runts, Giants, Dropped packets, late collisions, Input/Output errors.

#### *Policy review:*

Bandwidth, resource availability.



## Learning Outcomes and Assessment Criteria

Pass	Merit	Distinction
LO1 Examine networking principles and their protocols		LO1 & 2  D1 Considering a given scenario, identify the topology protocol selected for the efficient utilisation of a networking system.
P1 Discuss the benefits and constraints of different network types and standards.  P2 Explain the impact of network topology, communication and bandwidth requirements.	M1 Compare common networking principles and how protocols enable the effectiveness of networked systems.	
LO2 Explain networking devices and operations		
P3 Discuss the operating principles of networking devices and server types.  P4 Discuss the inter-dependence of workstation hardware with relevant networking software.	M2 Explore a range of server types and justify the selection of a server, considering a given scenario regarding cost and performance optimisation.	
LO3 Design efficient networked systems		D2 Design a maintenance schedule to support the networked system.
P5 Design a networked system to meet a given specification.  P6 Test and evaluate the design to meet the requirements and analyse user feedback.	M3 Install and configure network services and applications on your choice.	
LO4 Implement and diagnose networked systems		D3 Use critical reflection to evaluate own work and justify valid conclusions.
P7 Implement a networked system based on a prepared design.  P8 Document and analyse test results against expected results.	M4 Recommend potential enhancements for the networked systems.	

## Recommended Resources

### Textbooks

BURGESS, M. (2003) *Principles of Network and System Administration*. 2nd Ed. John Wiley and Sons Ltd.

HALLBERG, B. (2005) *Networking: A Beginner's Guide*. 4th Ed. Osborne/McGraw-Hill US.

LIMONCELLI, T. and HOGAN, C. (2001) *The Practice of System and Network Administration*. Addison-Wesley.

LOWE, D. (2005) *Networking All-in-One Desk Reference for Dummies*. 2nd Ed. Hungry Minds Inc.

OLIFER, N. and OLIFER, V. (2005) *Computer Networks: Principles, Technologies and Protocols for Network Design*. John Wiley and Sons Ltd.

STALLINGS, W. (2003) *Data and Computer Communications*. 7th Ed. (Prentice Hall)

SUBRAMANIAN, M. (2000) *Network Management: An Introduction to Principles and Practice*. Addison-Wesley.

TANENBAUM, A. (2002) *Computer Networks*. Prentice Hall PTR.

### Journals

*The Institute of Engineering and Technology*

### Links

This unit links to the following related units:

*Unit 8: Computer Systems Architecture*

*Unit 15: Transport Network Design*

*Unit 17: Network Security*

*Unit 35: Network Management*

*Unit 36: Client/Server Computing Systems*

## Unit 3: Professional Practice

**Unit code** Y/615/1620

**Unit type** Core

**Unit level** 4

**Credit value** 15

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### Introduction

The need to be effective as a communicator, critical thinker, analyser, team worker and interpreter is essential. Within the workplace these skills are needed on a daily basis to show proficiency in designated tasks as part of a job role. The development of academic competence, and also the continuation of life-long learning and Continuing Professional Development (CPD), is required to ensure that individuals have a valued set of interpersonal skills that can be applied to any situation or environment.

This unit provides a foundation for good practice in a variety of contexts. The ability to communicate effectively using different tools and mediums will ensure that practical, research, design, reporting and presentation tasks are undertaken professionally and in accordance with various communication conventions. In everyday life the ability to apply critical reasoning and solve problems are necessary skills to enable task resolution and facilitate effective decision-making. Working with others in a group environment academically or within the workplace is an integral part of everyday life. Therefore, understanding the dynamics of teams in terms of culture, roles and responsibilities will ensure that there is a better understanding and awareness of the importance and value of teamwork. Continuing professional development, self-improvement and working towards various goals is an area that is encouraged in the workplace through the appraisals framework. In addition, professional development extends into higher levels of learning and the need to demonstrate effective research skills and academic reporting skills is also required.

Among the topics included in this unit are: the development of communication skills and communication literacy; the use of qualitative and quantitative data to demonstrate analysis, reasoning and critical thinking; and tasks that require the integration of others within a team-based scenario and planning and problem-solving.

On successful completion of this unit students will be able to demonstrate leadership skills through the dynamics of team working, and through reflective practice be able to evaluate the contributions made as an individual and also of others. As a result they will develop skills such as communication literacy, critical thinking, analysis, reasoning and interpretation, which are crucial for gaining employment and developing academic competence.

## Learning Outcomes

By the end of this unit students will be able to:

- LO1 Demonstrate a range of interpersonal and transferable communication skills to a target audience.
- LO2 Apply critical reasoning and thinking to a range of problem-solving scenarios.
- LO3 Discuss the importance and dynamics of working within a team and the impact of team working in different environments.
- LO4 Examine the need for Continuing Professional Development (CPD) and its role within the workplace and for higher level learning.

## Essential Content

### LO1 **Demonstrate a range of interpersonal and transferable communication skills to a target audience**

#### *Effective communication:*

Verbal and non-verbal e.g. awareness and use of body language, openness and responsiveness, formal and informal dialogue and feedback to a range of different stakeholders; academic report writing; use of IT to enhance communication; use of source information to undertake research.

#### *Interpersonal skills:*

Soft skills e.g. personal effectiveness, working with others, use of initiative, negotiating skills, assertiveness skills and social skills.

#### *Time management skills:*

Prioritising workloads; setting objectives; using time effectively; making and keeping appointments; planning and scheduling tasks and activities.

### LO2 **Apply critical reasoning and thinking to a range of problem-solving scenarios**

#### *Specification of the problem:*

Definition of the problem; analysis and clarification.

#### *Identification of possible outcomes:*

Identification and assessment of various alternative outcomes.

#### *Tools and methods:*

Use of problem-solving methods and tools.

#### *Plan and implement:*

Sources of information; solution methodologies; selection and implementation of the best corrective action e.g. timescale, stages, resources, critical path analysis.

#### *Evaluation:*

Evaluation of whether the problem was solved or not; measurement of solution against specification and desired outcomes; sustainability.

### LO3 **Discuss the importance and dynamics of working within a team and the impact of team working in different environments**

#### *Working with others:*

Nature and dynamics of team and group work; informal and formal settings; purpose of teams and groups e.g. long-term corporate objectives/strategy; problem-solving and short-term development projects; flexibility/adaptability; team player.

*Teams and team building:*

Selecting team members e.g. specialist roles, skill and style/approach mixes; identification of team/work group roles; stages in team development e.g. team building, identity, loyalty, commitment to shared beliefs, team health evaluation; action planning; monitoring and feedback; coaching skills; ethics; effective leadership skills e.g. setting direction, setting standards, motivating, innovative, responsive, effective communicator, reliability, consistency.

**L04 Examine the need for Continuing Professional Development (CPD) and its role within the workplace and for higher level learning**

*Responsibilities:*

Own responsibilities e.g. personal responsibility, direct and indirect relationships and adaptability, decision-making processes and skills, ability to learn and develop within the work role; other e.g. employment legislation, ethics, employment rights and responsibilities.

*Performance objectives:*

Setting and monitoring performance objectives, measurement tools for success and achievement.

Continuing Professional Development: lifelong learning, training and development, personal development, professional development.

*Evidence criteria:*

Production data, personnel data, judgemental data; rating methods e.g. ranking, paired comparison, checklist, management by objectives; skills audit (personal profile using appropriate self-assessment tools); evaluating self-management; personal and interpersonal skills.

*Motivation and performance:*

Application and appraisal of motivational theories and techniques, rewards and incentives; manager's role; self-motivational factors.

*Development plan:*

Current performance; future needs; opportunities and threats to career progression; aims and objectives; achievement dates; review dates; learning programme/activities; action plans; personal development plans.

## Learning Outcomes and Assessment Criteria

Pass		Merit	Distinction
<b>LO1</b> Demonstrate a range of interpersonal and transferable communication skills to a target audience			<b>D1</b> Evaluate the effectiveness and application of interpersonal skills during the design and delivery of a training event.
<b>P1</b> Demonstrate, using different communication styles and formats, that you can effectively design and deliver a training event for a given target audience.	<b>P2</b> Demonstrate that you have used effective time management skills in planning an event.	<b>M1</b> Design a professional schedule to support the planning of an event, to include contingencies and justifications of time allocated.	
<b>LO2</b> Apply critical reasoning and thinking to a range of problem-solving scenarios			<b>D2</b> Critique the process of applying critical reasoning to a given task/activity or event.
<b>P3</b> Demonstrate the use of different problem-solving techniques in the design and delivery of an event.	<b>P4</b> Demonstrate that critical reasoning has been applied to a given solution.	<b>M2</b> Research the use of different problem-solving techniques used in the design and delivery of an event. <b>M3</b> Justify the use and application of a range of solution methodologies.	
<b>LO3</b> Discuss the importance and dynamics of working within a team and the impact of team working in different environments			<b>D3</b> Provide a critical evaluation of your own role and contribution to a group scenario.
<b>P5</b> Discuss the importance of team dynamics in the success and/or failure of group work.	<b>P6</b> Work within a team to achieve a defined goal.	<b>M4</b> Analyse team dynamics, in terms of the roles group members play in a team and the effectiveness in terms of achieving shared goals.	
<b>LO4</b> Examine the need for Continuing Professional Development (CPD) and its role within the workplace and for higher level learning			

Pass	Merit	Distinction
<p><b>P7</b> Discuss the importance of CPD and its contribution to own learning.</p> <p><b>P8</b> Produce a development plan that outlines responsibilities, performance objectives and required skills, knowledge and learning for own future goals.</p>	<p><b>M5</b> Compare and contrast different motivational theories and the impact they can have on performance within the workplace.</p>	<p><b>D4</b> Evaluate a range of evidence criteria that is used as a measure for effective CPD.</p>



## Recommended Resources

### Textbooks

Cottrell, S. (2001) *Critical Thinking Skills: Developing Effective Analysis and Argument*. 2nd Ed. Palgrave Macmillan.

Forde, C. (2006) *Professional Development, Reflection and Enquiry*. Sage Publications.

Megginson, D. and Whitaker, V. (2007) *Continuing Professional Development*. 2nd Ed. Chartered Institute of Personnel and Development.

Winstanley, D. (2005) *Personal Effectiveness: A guide to action*. Chartered Institute of Personnel and Development.

### Journals

Journal of Group Dynamics

Professional Development in Education

### Websites

www.thinkwatson.com Critical Thinking Resources  
"Critical Thinking Correlation Studies" (Research)

ipda.org.uk International Professional Development Association  
(General Reference)

### Links

This unit links to the following related units:

*Unit 6: Managing a Successful Computing Project*

*Unit 13: Computing Research Project*

# Unit 4: Database Design & Development

<b>Unit code</b>	<b>H/615/1622</b>
<b>Unit type</b>	<b>Core</b>
<b>Unit level</b>	<b>4</b>
<b>Credit value</b>	<b>15</b>

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## Introduction

Organisations depend on their databases to provide information essential for their day-to-day operations and to help them take advantage of today's rapidly growing and maturing e-commerce opportunities. An understanding of database tools and technologies is an essential skill for designing and developing systems to support them.

Database systems continue to demand more complex data structures and interfaces, as applications get increasingly sophisticated. Most organisations collect and store large volumes of data, either on their own systems or in the cloud, and this data is used not just for the operational running of their business but also mined for other more intelligent and complex applications. Databases stand as the back-end of most systems used by organisations for their operations.

Database design and development is a fundamental and highly beneficial skill for computing students to master, regardless of their specialism.

The aim of this unit is to give students opportunities to develop an understanding of the concepts and issues relating to database design and development, as well as to provide the practical skills to translate that understanding into the design and creation of complex databases.

Topics included in this unit are: examination of different design tools and techniques; examination of different development software options; considering the development features of a fully functional robust solution covering data integrity, data validation, data consistency, data security and advanced database querying facilities across multiple tables; appropriate user interfaces for databases and for other externally linked systems; creating complex reports/dashboards, testing the system against the user and system requirements; and elements of complete system documentation.

On successful completion of this unit students will be able to use appropriate tools to design and develop a relational database system for a substantial problem. They will be able to test the system to ensure it meets user and system requirements and fully document the system by providing technical and user documentation. For practical purposes, this unit covers relational databases and related tools and techniques. A brief overview of object-oriented databases will also be covered.

Students will develop skills such as communication literacy, critical thinking, analysis, reasoning and interpretation, which are crucial for gaining employment and developing academic competence.

## Learning Outcomes

By the end of this unit students will be able to:

- LO1. Use an appropriate design tool to design a relational database system for a substantial problem.
- LO2. Develop a fully functional relational database system, based on an existing system design.
- LO3. Test the system against user and system requirements.
- LO4. Produce technical and user documentation.

## Essential Content

### **L01 Use an appropriate design tool to design a relational database system for a substantial problem**

The role of database systems e.g. as back-end systems, in e-commerce, for data mining applications etc.

Determining user and system requirements.

Design tools and techniques for a relational database system.

Logical design for relational databases e.g. tables, data elements, data types, indexes, primary/foreign keys, entity relationship modelling, referential integrity, data normalisation to third normal form.

Designs for data integrity, data validations, data security and data controls.

User interface design.

Output designs for user requirements.

Overview of object-oriented databases and their design tools.

### **L02 Develop a fully functional relational database system, based on an existing system design**

Consideration of database and platform options for system development.

Examination of different software development options for developing the relational database system.

Implementation of the physical data model based on the logical model.

Data stores, internal storage and external storage (e.g. the cloud).

Implementation of security elements in databases.

Relational databases with controls like data validation using; input masks, drop down lists, option buttons.

User interface for requirements, functionality, reliability, consistency and performance.

Consideration of interface links with other systems e.g. internet-based applications.

Data manipulation using appropriate query tools, including complex queries to query across multiple tables, and using functions and formulae.

Database maintenance and data manipulation: inserts, updates, amendments, deletions, data backup and recovery.

System reports using report writing tools and report generators, dashboards.

### **L03 Test the system against user and system requirements**

Identify elements of the system that need to be tested.

Consider data that should be used to fully test the system.

Match tests against user and system requirements.

Test procedures to be used: test plans, test models e.g. white box, black box; testing documentation.

Functional and system testing and testing the robustness of the system, including help menus, pop-ups, hot-spots, data validation checks.

### **L04 Produce technical and user documentation**

Technical and user documentation and their contents.

## Learning Outcomes and Assessment Criteria

Pass	Merit	Distinction
<b>LO1</b> Use an appropriate design tool to design a relational database system for a substantial problem		<b>D1</b> Assess the effectiveness of the design in relation to user and system requirements.
<b>P1</b> Design a relational database system using appropriate design tools and techniques, containing at least four interrelated tables, with clear statements of user and system requirements.	<b>M1</b> Produce a comprehensive design for a fully functional system which includes interface and output designs, data validations and data normalisation.	
<b>LO2</b> Develop a fully functional relational database system, based on an existing system design		<b>LO2 &amp; 3</b> <b>D2</b> Evaluate the effectiveness of the database solution in relation to user and system requirements, and suggest improvements.
<b>P2</b> Develop the database system with evidence of user interface, output and data validations, and querying across multiple tables.	<b>M2</b> Implement a fully functional database system which includes system security and database maintenance.	
<b>P3</b> Implement a query language into the relational database system.	<b>M3</b> Assess whether meaningful data has been extracted through the use of query tools to produce appropriate management information.	
<b>LO3</b> Test the system against user and system requirements		
<b>P4</b> Test the system against user and system requirements.	<b>M4</b> Assess the effectiveness of the testing, including an explanation of the choice of test data used.	
<b>LO4</b> Produce technical and user documentation		<b>D3</b> Assess any future improvements that may be required to ensure the continued effectiveness of the database system.
<b>P5</b> Produce technical and user documentation.	<b>M5</b> Produce technical and user documentation for a fully functional system, including diagrams showing movement of data through the system, and flowcharts describing how the system works.	

## Recommended Resources

### Textbooks

Churcher, C. (2012) Beginning Database Design: From Novice to Professional. 2nd Ed. Apress.

Connolly, T. and Begg, C. (2014) Database Systems: A Practical Approach to Design, Implementation and Management. 6th Ed. Global Edition. Pearson.

Kroemke, D. and Auer, D. (2012) Database Concepts: International Edition. 6th Ed. Pearson.

Paulraj, P (2008). Database Design and Development: An Essential Guide for IT Professional. Wiley.

Stephens, R. (2008) Beginning Database Design Solutions. Wrox.

### Journals

*International Journal of Database Management Systems*

*Journal of Database Management*

*The Computer Journal*

*Journal of Systems Analysis and Software Engineering*

*Journal of Emerging Trends in Computing and Information Sciences*

### Websites

<a href="http://www.lynda.com">www.lynda.com</a>	Database Training (Tutorials)
<a href="http://mva.microsoft.com">mva.microsoft.com</a>	Microsoft Virtual Academy "Database Development" (Training)
<a href="http://mva.microsoft.com/ebooks">mva.microsoft.com/ebooks</a>	Microsoft Virtual Academy "Microsoft Press" (E-Books)

### Links

This unit links to the following related units:

*Unit 7: Strategic Information Systems*

*Unit 38: Database Management Systems*

# Unit 5: Security

<b>Unit code</b>	<b>K/615/1623</b>
<b>Unit type</b>	<b>Core</b>
<b>Unit level</b>	<b>4</b>
<b>Credit value</b>	<b>15</b>

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## Introduction

Security is one of the most important challenges modern organisations face. Security is about protecting organisational assets, including personnel, data, equipment and networks from attack through the use of prevention techniques in the form of vulnerability testing/security policies and detection techniques, exposing breaches in security and implementing effective responses.

The aim of this unit is to provide students with knowledge of security, associated risks and how security breaches impact on business continuity. Students will examine security measures involving access authorisation, regulation of use, implementing contingency plans and devising security policies and procedures.

This unit introduces students to the detection of threats and vulnerabilities in physical and IT security, and how to manage risks relating to organisational security.

Among the topics included in this unit are Network Security design and operational topics, including address translation, DMZ, VPN, firewalls, AV and intrusion detection systems. Remote access will be covered, as will the need for frequent vulnerability testing as part of organisational and security audit compliance.

Students will develop skills such as communication literacy, critical thinking, analysis, reasoning and interpretation, which are crucial for gaining employment and developing academic competence.

## Learning Outcomes

By the end of this unit students will be able to:

- LO1 Assess risks to IT security.
- LO2 Describe IT security solutions.
- LO3 Review mechanisms to control organisational IT security.
- LO4 Manage organisational security.



## Essential Content

### L01 Assess risks to IT security

*IT security risks:*

Risks: unauthorised use of a system; unauthorised removal or copying of data or code from a system; damage to or destruction of physical system assets and environment; damage to or destruction of data or code inside or outside the system; naturally occurring risks.

Organisational security: business continuance; backup/restoration of data; audits; testing procedures e.g. data, network, systems, operational impact of security breaches, WANs, intranets, wireless access systems.

### L02 Describe IT security solutions

*IT security solution evaluation:*

Network Security infrastructure: evaluation of NAT, DMZ, FWs.

Network performance: RAID, Main/Standby, Dual LAN, web server balancing.

Data security: explain asset management, image differential/incremental backups, SAN servers.

Data centre: replica data centres, virtualisation, secure transport protocol, secure MPLS routing and remote access methods/procedures for third-party access.

Security vulnerability: logs, traces, honeypots, data mining algorithms, vulnerability testing.

### L03 Review mechanisms to control organisational IT security

*Mechanisms to control organisational IT security:*

Risk assessment and integrated enterprise risk management: network change management, audit control, business continuance/disaster recovery plans, potential loss of data/business, intellectual property, hardware and software; probability of occurrence e.g. disaster, theft; staff responsibilities; Data Protection Act; Computer Misuse Act; ISO 3001 standards.

Company regulations: site or system access criteria for personnel; physical security types e.g. biometrics, swipe cards, theft prevention.

### L04 Manage organisational security

*Manage organisational security:*

Organisational security: policies e.g. system access, access to internet email, access to internet browser, development/use of software, physical access and protection, 3rd party access, business continuity, responsibility matrix.

Controlling security risk assessments and compliance with security procedures and standards e.g. ISO/IEC 17799:2005 Information Technology (Security Techniques – code of practice for information security management); informing colleagues of their security responsibilities and confirming their understanding at suitable intervals; using enterprise risk management for identifying, evaluating, implementing and follow up of security risks according to ISO 3001 standards.

Security: tools e.g. user log-on profiles to limit user access to resources; online software to train and update staff; auditing tools to monitor resource access; security audits; penetration testing; ethical hacking; gathering and recording information on security; initiating suitable actions for remediation.

## Learning Outcomes and Assessment Criteria

Pass		Merit	Distinction
<b>LO1</b> Assess risks to IT security			<b>LO1 &amp; 2</b> <b>D1</b> Investigate how a 'trusted network' may be part of an IT security solution.
<b>P1</b> Identify types of security risks to organisations.	<b>P2</b> Describe organisational security procedures.	<b>M1</b> Propose a method to assess and treat IT security risks.	
<b>LO2</b> Describe IT security solutions			
<b>P3</b> Identify the potential impact to IT security of incorrect configuration of firewall policies and third-party VPNs.	<b>P4</b> Show, using an example for each, how implementing a DMZ, static IP and NAT in a network can improve Network Security.	<b>M2</b> Discuss three benefits to implement network monitoring systems with supporting reasons.	
<b>LO3</b> Review mechanisms to control organisational IT security			<b>D2</b> Consider how IT security can be aligned with organisational policy, detailing the security impact of any misalignment.
<b>P5</b> Discuss risk assessment procedures.	<b>P6</b> Explain data protection processes and regulations as applicable to an organisation.	<b>M3</b> Summarise the ISO 31000 risk management methodology and its application in IT security. <b>M4</b> Discuss possible impacts to organisational security resulting from an IT security audit.	
<b>LO4</b> Manage organisational security			<b>D3</b> Evaluate the suitability of the tools used in an organisational policy.
<b>P7</b> Design and implement a security policy for an organisation.	<b>P8</b> List the main components of an organisational disaster recovery plan, justifying the reasons for inclusion.	<b>M5</b> Discuss the roles of stakeholders in the organisation to implement security audit recommendations.	

## Recommended Resources

### Textbooks

- Alexander, D. et al. (2008) *Information Security Management Principles*. BSC.
- Steinberg, R. (2011) *Governance, Risk Management, and Compliance: It Can't Happen to Us – Avoiding Corporate Disaster While Driving Success*. Wiley.
- Tipton, H. (2010) *Information Security Management Handbook*. 4th Ed. Auerbach Pubs.

### Websites

<a href="http://www.bcs.org">www.bcs.org</a>	British Computer Society (General Reference)
<a href="http://www.bsa.org.uk">www.bsa.org.uk</a>	Business Software Alliance (General Reference)
<a href="http://www.fast.org.uk">www.fast.org.uk</a>	Federation Against Software Theft (General Reference)
<a href="http://www.ico.gov.uk">www.ico.gov.uk</a>	Information Commissioners Office (General Reference)

### Links

This unit links to the following related units:

*Unit 17: Network Security*

*Unit 23: Cryptography*

*Unit 24: Forensics*

*Unit 25: Information Security Management*

# **Unit 6: Managing a Successful Computing Project**

<b>Unit code</b>	<b>T/615/1625</b>
<b>Unit type</b>	<b>Core unit</b>
<b>Unit level</b>	<b>4</b>
<b>Credit value</b>	<b>15</b>

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## **Introduction**

This unit is assessed by a Pearson-set assignment. The project brief will be set by the centre, based on a theme provided by Pearson (this will change annually). The theme and chosen project within the theme will enable students to explore and examine a relevant and current topical aspect of computing in the context of a business environment.

In order to ensure that client expectations are met in terms of requirements, deadlines and the estimated cost, the work to deliver new computer systems or services to business organisations, or to revamp the existing ones, is always organised in projects. Therefore, skilful, knowledgeable and experienced project managers have always been in demand. It is projected that 15.7 million new project management roles will be created around the world by 2020.

The aim of this unit is to offer students an opportunity to demonstrate the skills required for managing and implementing a project. They will undertake independent research and investigation for carrying out and executing a computing project which meets appropriate aims and objectives.

On successful completion of this unit students will have the confidence to engage in decision-making, problem-solving and research activities using project management skills. They will have the fundamental knowledge and skills to enable them to investigate and examine relevant computing concepts within a work-related context, determine appropriate outcomes, decisions or solutions and present evidence to various stakeholders in an acceptable and understandable format.

## **Learning Outcomes**

By the end of this unit students will be able to:

- LO1 Establish project aims, objectives and timeframes based on the chosen theme.
- LO2 Conduct small-scale research, information gathering and data collection to generate knowledge to support the project.
- LO3 Present the project and communicate appropriate recommendations based on meaningful conclusions drawn from the evidence findings and/or analysis.
- LO4 Reflect on the value gained from conducting the project and its usefulness to support sustainable organisational performance.

## Essential Content

### **L01 Establish project aims, objectives and timeframes based on the chosen theme**

#### *Project management:*

What is project management and what does it involve?

The key stages of project management.

The advantages of using project management and why it is important.

#### *Initiation of the project and project planning phase:*

Scoping a project – defining objectives, scope, purpose and deliverables to be produced.

Steps and documentation required in the initiation phase.

Developing the project plan, including planning for timescales and time management, cost, quality, change, risk and issues.

The work breakdown structure.

Use of Bar and Gantt Charts for effective planning.

### **L02 Conduct small-scale research, information gathering and data collection to generate knowledge to support the project**

#### *Project execution phase:*

Selecting appropriate methods of information gathering, data collection and material resourcing.

The distinct phases which support a coherent and logical argument.

Use of secondary research to inform a primary empirical study.

Qualitative and quantitative research methods.

#### *Field work:*

Selecting a sample of the consumer market, businesses or individuals (those who meet certain characteristics relevant to the research theme) is used to gather data (qualitative or quantitative).

Sampling approaches and techniques, including probability and non-probability sampling.

#### *Ethics, reliability and validity:*

All research should be conducted ethically – how is this achieved and reported?

Research should also be reliable (similar results achieved from a similar sample) and valid (the research should measure what it aimed to measure).

*Analysing information and data:*

Using data collection tools such as interviews and questionnaires.

Using analytical techniques such as trend analysis, coding or typologies.

**LO3 Present the project and communicate appropriate recommendations based on meaningful conclusions drawn from the evidence findings and/or analysis**

*Communicating outcomes:*

Consider the method (e.g. written, verbal) and the medium (e.g. report, online, presentation).

Both method and medium will be influenced by the project research and its intended audience.

*Convincing arguments:*

All findings/outcomes should be convincing and presented logically where the assumption is that the audience has little or no knowledge of the project process.

Developing evaluative conclusions.

*Critical and objective analysis and evaluation:*

Secondary and primary data should be critiqued and considered with an objective mindset.

Objectivity results in more robust evaluations where an analysis justifies a judgement.

**LO4 Reflect on the value gained from conducting the project and its usefulness to support sustainable organisational performance**

*Reflection for learning and practice:*

*The difference between reflecting on performance and evaluating a project – the former considers the research process, information gathering and data collection, the latter the quality of the research argument and use of evidence.*

*The cycle of reflection:*

To include reflection in action and reflection on action.

How to use reflection to inform future behaviour, particularly directed towards sustainable performance.

*Reflective writing:*

Avoiding generalisation and focusing on personal development and the research journey in a critical and objective way.

*Generalisation:*

Many studies result in generalised findings. Research which has its basis in a specific field such as Human Resource Management (HRM) and in a specific context should avoid generalised conclusions.

Outcomes should be specific and actionable.



## Learning Outcomes and Assessment Criteria

Pass		Merit	Distinction
<b>LO1</b> Establish project aims, objectives and timeframes based on the chosen theme			<b>LO1 &amp; 2</b>  <b>D1</b> Critically evaluate the project management process and appropriate research methodologies applied.
<b>P1</b> Devise project aims and objectives for a chosen scenario.  <b>P2</b> Produce a project management plan that covers aspects of cost, scope, time, quality, communication, risk and resources.  <b>P3</b> Produce a work breakdown structure and a Gantt Chart to provide timeframes and stages for completion.	<b>M1</b> Produce a comprehensive project management plan, milestone schedule and project schedule for monitoring and completing the aims and objectives of the project.		
<b>LO2</b> Conduct small-scale research, information gathering and data collection to generate knowledge to support the project			
<b>P4</b> Carry out small-scale research by applying qualitative and quantitative research methods appropriate for meeting project aims and objectives.	<b>M2</b> Evaluate the accuracy and reliability of different research methods applied.		
<b>LO3</b> Present the project and communicate appropriate recommendations based on meaningful conclusions drawn from the evidence findings and/or analysis			<b>LO3 &amp; 4</b>  <b>D2</b> Critically evaluate and reflect on the project outcomes, the decision-making process and changes or developments of the initial project management plan to support justification of recommendations and learning during the project.
<b>P5</b> Analyse research and data using appropriate tools and techniques.  <b>P6</b> Communicate appropriate recommendations as a result of research and data analysis to draw valid and meaningful conclusions.	<b>M3</b> Evaluate the selection of appropriate tools and techniques for accuracy and authenticity to support and justify recommendations.		

Pass	Merit	Distinction
<b>LO4</b> Reflect on the value gained from conducting the project and its usefulness to support sustainable organisational performance		
<b>P7</b> Reflect on the value of undertaking the research to meet stated objectives and own learning and performance.	<b>M4</b> Evaluate the value of the project management process and use of quality research to meet stated objectives and support own learning and performance.	

## Additional Evidence Requirements

In addition to the above assessment criteria, students will also be required to complete a project logbook to record ideas, changes and developments as they progress and complete the project.

## Recommended Resources

### Textbooks

Costley, C., Elliot, G. and Gibbs, P. (2010) *Doing Work Based Research: Approaches to Enquiry for Insider-researchers*. London: SAGE.

Dawson, C. (2016) *Projects in Computing and Information Systems: A Student's Guide*. UK: Pearson Education.

Flick, U. (2011) *Introducing Research Methodology: A Beginner's Guide to Doing a Research Project*. London: SAGE.

Gray, D. (2009) *Doing Research in the Real World*. 2nd Ed. London: SAGE.

Guay, M., Schreiber, D. and Briones, S. (2016) *The Ultimate Guide to Project Management: Learn everything you need to successfully manage projects and get them done*. Free Kindle Edition. US: Zapier Inc.

Lock, D. (2013) *Project Management 8th Edition*. UK: Routledge.

Pinto, J.K. (2015) *Project Management: Achieving Competitive Advantage* 4th Ed. Pearson.

### Journals

*International Journal of Quantitative and Qualitative Research*  
*Qualitative Research Journal*

### Websites

[www.gov.uk/government/publications](http://www.gov.uk/government/publications)

Department of Business Innovations and Skills "Guidelines for managing projects – How to organise, plan and control projects." (Report)

### Links

This unit links to the following related units:

*Unit 3: Professional Practice*

*Unit 13: Computing Research Project*

*Unit 14: Business Intelligence*

*Unit 34: Systems Analysis & Design*

# **Unit 7: Strategic Information Systems**

<b>Unit code</b>	<b>A/615/1626</b>
<b>Unit type</b>	<b>Optional</b>
<b>Unit level</b>	<b>4</b>
<b>Credit value</b>	<b>15</b>

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## **Introduction**

Information is the most valuable resource that an organisation possesses. The effective gathering, protection, analysis, processing and dissemination of information is vital to the success of any organisation. As globalisation and the 24-hour economy develop and increase, organisations must ensure that their information systems are reliable, efficient and able to cope with rapid change.

This unit introduces students to the importance of information to organisations. It will examine how systems can be used to support core business functions and enable organisations to be more productive and competitive within the global marketplace.

Students will be required to analyse the information needs of an organisation at different levels and within different functional areas. It is important that computing professionals are able to understand how an organisation works and how it uses information in order to be able to design, implement, maintain and manage secure information systems to support its operations.

Among the topics included in this unit are understanding organisations in terms of their information needs and the variances within different functional areas. Examination of different information systems at the operational, tactical and strategic levels will be required, in addition to evaluating their effectiveness and role in terms of decision making and gaining competitive advantage.

On successful completion of this unit students will have an insight into the types of systems and technologies available for effective information processing. Critical analysis will also be used to examine the integrated role that each of these play in contributing to the efficiency and competitiveness of organisations.

As a result students will develop skills such as communication literacy, critical thinking, analysis, reasoning and interpretation, which are crucial for gaining employment and developing academic competence.

## Learning Outcomes

By the end of this unit students will be able to:

- LO1 Analyse the information requirements of organisations.
- LO2 Discuss the types of information systems that are used within all levels of an organisation.
- LO3 Demonstrate the use of an information system to produce management information.
- LO4 Evaluate the effectiveness of strategic information systems.

## Essential Content

### L01 Analyse the information requirements of organisations

#### *Functional area information requirements:*

Finance and accounts for payroll, pensions, supplier payments and invoicing etc., human resources e.g. employee records, personnel data, appraisals, CPD etc., stock control, sales, marketing, research and development, production, distribution, IT, customer service and administration.

#### *Information needs:*

How different functional areas use and process data effectively; the integration of data and information within an organisation.

#### *Requirements analysis:*

The inputs, outputs and processing activities; information distribution requirements e.g. by location, department, individual/customer.

### L02 Discuss the types of information systems that are used within all levels of an organisation

#### *Information systems types:*

Business information systems, decision support systems, management information systems, strategic/executive information systems, office information systems, transaction processing systems, expert systems, global information systems, data warehouse systems, enterprise systems, enterprise resource planning systems, integrated information systems.

#### *Categories of information systems:*

Operational, tactical and strategic information systems.

#### *Information and data:*

Definition of information and data, sources of information, information requirements and the needs for information at different levels within an organisation; storing information and its importance with regard to security, accuracy and relevance; outputs e.g. payroll, invoicing, ordering, bookings, stock control, personnel records, goods tracking, decision-making, marketing, customer service.

### **L03 Demonstrate the use of an information system to produce management information**

#### *Management information:*

Reports e.g. sales report, college enrolment statistics, marketing analysis (brick v click), trends in the market, competition and market share.

#### *Gathering information:*

Defining requirements; establishing sources of information; defining other factors to be considered e.g. constraints and access to information.

#### *Selecting information:*

Analysis of information in terms of validity, accuracy, currency and relevancy; identifying and rationalising meaningful information from data sets.

#### *Uses:*

Proficiency in terms of accessing quality information that can be used for decision-making, problem-solving, predictions, trending and forecasting.

### **L04 Evaluate the effectiveness of strategic information systems**

#### *Models for strategic information systems:*

Porters Competitive Advantage and Wiseman's Strategic Planning Process.

#### *Competitive advantage:*

How can competitive advantage be measured and attributed to the implementation of a strategic information system?

#### *Gaining competitive advantage:*

Delivering a differentiated product or service; delivering a product or service at a lower cost; specific segmentation of the market e.g. targeted marketing to specific target audiences; innovative product or service design and implementation.

## Learning Outcomes and Assessment Criteria

Pass	Merit	Distinction
<b>LO1</b> Analyse the information requirements of organisations		<b>D1</b> Evaluate the inputs, outputs and processing activities of a selected organisation.
<b>P1</b> Discuss the information needs and requirements for the functional departments of an organisation.  <b>P2</b> Produce an input/output (I/O) diagram to represent the data and information requirements of a functional department.	<b>M1</b> Compare and contrast different processing activities that occur within functional departments within an organisation.	
<b>LO2</b> Discuss the types of information systems that are used within all levels of an organisation		<b>D2</b> Differentiate between the function and purpose of information systems at different levels within an organisation.
<b>P3</b> Describe the function of different information systems.  <b>P4</b> Discuss the information needs required at differing levels within an organisation.	<b>M2</b> Analyse the effectiveness of information systems at the operational, tactical and strategic levels within an organisation.	
<b>LO3</b> Demonstrate the use of an information system to produce management information		<b>D3</b> Critique, with examples, how a given organisation can use information for effective decision-making and forecasting.
<b>P5</b> Demonstrate the use of an information system for management reporting purposes.  <b>P6</b> Discuss the importance of an organisation having data and information that is current, valid and accurate.	<b>M3</b> Analyse the constraints that an organisation can face when gathering data and information.	



Pass	Merit	Distinction
<b>LO4</b> Evaluate the effectiveness of strategic information systems		<b>D4</b> Evaluate how strategic information systems can contribute to the competitiveness of organisations.
<b>P7</b> Identify different models that can be applied to strategic information systems.	<b>M4</b> Justify the ways in which an organisation can obtain competitive advantage within a global market.	

## Recommended Resources

### Textbooks

Peppard, J. (2016) *The Strategic Management of Information Systems: Building a Digital Strategy*. 4th Ed. John Wiley & Sons.

Robson, W. (1997) *Strategic Management and Information Systems: An Integrated Approach*. 2nd Ed. Financial Times/ Prentice Hall.

Ward, J. (2002) *Strategic Planning for Information Systems*. 3rd Ed. John Wiley & Sons.

Whitely, D. (2013) *An Introduction to Information Systems*. Palgrave Macmillan.

### Journals

*The Journal of Strategic Information Systems*

*Information Systems Journal*

### Websites

it.toolbox.com	ToolBox.com "Strategic Information System Toolbox" (Wiki)
www.mbaknol.com	MBA Knowledge Base "Strategic Information Systems" (Article)

### Links

This unit links to the following related units:

*Unit 4: Database Design & Development*

*Unit 38: Database Management Systems*

# **Unit 8: Computer Systems Architecture**

**Unit code** J/615/1628

**Unit level** 4

**Credit value** 15

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## **Introduction**

As technology develops, it is important to have a working foundation on which to build your knowledge. Despite hardware and software being constantly updated and seemingly becoming more complex, students with a solid, underpinned knowledge about computer systems architecture will not only be able to answer questions like, "How does a central processor work?", "What does an operating system do?", "How is information stored?", "What is an instruction set?" and "How do I actually connect to the internet?", but will also be able to transfer and apply their knowledge and skill to many other areas.

This unit introduces students to the foundations of computer systems architecture together with the integrated hardware and software components and subsystems that enable and allow data to be input, processed and output. The unit further explores the concepts of operating systems, hardware management and computer networks together with the practical skills needed to diagnose, troubleshoot and maintain computer systems taking the security of these systems into consideration.

Among the topics included in this unit are: CPUs, memory, input & output devices, ALU operations, program execution, operating systems (including kernel, file systems, API and system calls), hardware management, installation, firmware, device drivers, networking (including OSI and TCP/IP models), error and information gathering, fault diagnostics, security and problem resolution.

On successful completion of this unit, students will be able to explain the purpose and role of operating systems, the relationship between the subsystems embedded within a central processing unit, the core hardware and software components associated with computer operations and be able to configure the hardware and systems needed to establish a computer network together with practical diagnostic and troubleshooting techniques. As a result they will develop skills such as communication literacy, critical thinking, analysis, reasoning and interpretation which are crucial for gaining employment and developing academic competence.

## Learning Outcomes

By the end of this unit students will be able to:

- L01 Explain the relationships between hardware components and the subsystems used in a computer system.
- L02 Categorise the key features and services provided by different computer operating systems and hardware.
- L03 Use network communication technology and the associated services to connect computer systems.
- L04 Demonstrate diagnostic and troubleshooting skills to solve hardware, software and networking related issues.

## Essential Content

### **L01 Explain the relationships between hardware components and the subsystems used in a computer system**

*Hardware components and subsystems:*

Computers consist of four main subsystems (Von Neumann Architecture, Memory, CPU (Arithmetical & Logic Unit (ALU) and Control Unit), Input and output Systems).

Review Memory subsystems regarding programs and data (variable) storage (ROM, RAM, size, speed, operation and structure).

Explore Input/output systems and structure (communicating with other devices (screen, keyboard, printers, etc.), storage (Hard Disk Drives (HDD), DVD's, etc.), IO controllers & data transfer (speed, buffers, interrupts, etc.).

Discuss ALU subsystems (mathematical & logical operations, registers, bus, etc.).

Investigate how the Control Unit works (program code & language, fetch, decode, execute, halt) including an introduction to machine language instructions (reduced instruction and complex instruction sets: arithmetic, compare, branch, control, Program Counter (PC), Instruction Register (IR) and Instruction decoder.

### **L02 Categorise the key features and services provided by different computer operating systems and hardware**

*Operating system types and hardware:*

Introduce different operating systems and types (desktop & server/network, mobile, embedded systems (e.g. Windows 10, Windows Server 2012/2016, Linux, Unix, MacOS, IOS, Android, etc.).

Hardware management and connections including the hardware abstraction layer, firmware and device drivers (network cards, video cards, optical drives, magnetic disks, solid state drives, RAID, etc.).

Installing and configuring common peripheral devices (mouse, keyboard, scanners, biometrics, webcams, smartcards, motion sensor, printers, speakers, display devices, etc.).

*Features and services:*

Introduce Operating Systems Architecture (Kernel, File Systems, API).

Review how operating systems function and provide services (user interface, memory management (Direct Memory Access), file management).

**LO3 Use network communication technology and the associated services to connect computer systems**

*Networking technology and services:*

Introduction to network protocols (HTTP, SMTP, TCP, UDP, etc.) including the OSI and TCP/IP models.

Hardware and network addresses (physical/MAC addresses, logical/IP addresses).

Network devices and components (network interface cards (NIC), network cables, switches, wireless access points, routers, network services).

*Connecting computer systems to a network:*

Introduce topologies including physical and logical: bus, star (extended star), ring and mesh.

Establishing network connections including wired/wireless client configuration.

Security of networking systems and the importance of this.

**LO4 Demonstrate diagnostic and troubleshooting skills to solve hardware, software and networking related issues.**

*Hardware, software & networking issues and maintenance:*

Different hardware and software related problems and the implication of choices with regards to system administration, impact on users and business operations.

*Explore methods of maintenance with regard to hardware and software.*

*Diagnostic and troubleshooting skills:*

Discuss information gathering methods and techniques (such as: system documents, user information, error codes, error messages, failure domain, problem history, etc.).

Consider solutions to security problems.

Analyse evidence and establish possible problem domains, complexity, priority and impact; introduce 'Research, Determine, Implement, Review, Document (and Repeat)'.

Creating and updating system documentation.

## Learning Outcomes and Assessment Criteria

Pass		Merit	Distinction
<b>LO1</b> Explain the relationships between hardware components and the subsystems used in a computer system			<b>LO1 &amp; 2</b>  <b>D1</b> Evaluate the structure and functions of an operating system including memory, processor, device, file, security, performance and error management with regards to functionality, operation and dependency.
<b>P1</b> Identify the main subsystems of a computer and explain how they are organised and connected.  <b>P2</b> Explain the purpose of the Central Processing Unit (CPU) and include details on its operation.	<b>M1</b> Review the operation of the CPU and assess its dependency and performance with regards to associated systems and subsystems.		
<b>LO2</b> Categorise the key features and services provided by different computer operating systems and hardware			
<b>P3</b> Describe a range of different operating systems including the purpose, use and hardware requirements of each.  <b>P4</b> Discuss the key features associated with the architecture of an operating system.	<b>M2</b> Analyse the services provided by an operating system with regards to user interaction, memory management, file management and hardware support.		
<b>LO3</b> Use network communication technology and the associated services to connect computer systems			<b>D2</b> Evaluate the OSI and TCP/IP models with regards to hierarchy, layers and services including information on the associated protocols and hardware.
<b>P5</b> Explain the relationships between hardware and network addresses including their use with regards to networking devices and components.  <b>P6</b> Setup, configure and document appropriate hardware and software systems to establish computer based network connectivity.	<b>M3</b> Compare common physical and logical networking topologies and explain the differences and purposes of each.		

Pass	Merit	Distinction
<b>L04</b> Demonstrate diagnostic and troubleshooting skills to solve hardware, software and networking related issues.		<b>D3</b> Assess any future improvements that may be required to ensure the continued effectiveness of a computer system.
<b>P7</b> Use information gathering methods to assess, troubleshoot and document solutions to a number of different technical hardware, software and networking issues.  <b>P8</b> Conduct and document a range of maintenance activities with regards to computer hardware and software.	<b>M4</b> Review different diagnostic and troubleshooting skills including data gathering methods and techniques.	



## Recommended Resources

### Textbooks

Docter, Q., Dulaney, E. and Skandier, T. (2015) *CompTIA A+ Complete Study Guide: Exams 220-901 and 220-902*. USA: John Wiley & Sons Inc.

Mueller, S. (2015) *Upgrading and Repairing PCs*. USA: Que Publishing.

Patterson, D. and Hennessy, J. (2013) *Computer Organization and Design: The Hardware/Software Interface*. USA: Elsevier.

### Links

This unit links to the following related units:

*Unit 2: Networking*

*Unit 15: Transport Network Design*

*Unit 17: Network Security*

*Unit 35: Network Management*

*Unit 36: Client/Server Computing Systems*

# **Unit 9: Software Development Lifecycles**

**Unit code** J/615/1631

**Unit level** 4

**Credit value** 15

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## **Introduction**

The software development lifecycle is an integrated process that promotes building good quality, secure software throughout the entire development process. The aim of this unit is to provide students with the knowledge and skills needed to understand software development lifecycles and to demonstrate their knowledge by implementing a software development lifecycle with a suitable methodology.

This unit introduces students to lifecycle decision-making at different stages of the software development process. Students will examine various lifecycle models and appreciate their particular characteristics to understand which project environments they are most appropriate for. Theoretical understanding will be translated into practical skills through an actual software development lifecycle project and students will become confident in the use of particular tools and techniques relevant to a chosen methodology.

Among the topics included in this unit are iterative and sequential models of software development lifecycles and reference frameworks for initially capturing conceptual data and information through a feasibility study and requirement gathering techniques through to analysis, design and software implementation activities.

As a result students will develop skills such as communication literacy, critical thinking, analysis, reasoning and interpretation, which are crucial for gaining employment and developing academic competence.

## **Learning Outcomes**

By the end of this unit students will be able to:

- LO1 Describe different software development lifecycles.
- LO2 Explain the importance of a feasibility study.
- LO3 Undertake a software development lifecycle.
- LO4 Discuss the suitability of software behavioural design techniques.

## Essential Content

### LO1 Describe different software development lifecycles

*Software development lifecycles:*

Lifecycle models: understanding and use of predictive (Waterfall, Prototyping, RAD) and adaptive (Spiral, Agile, DSDM) software development models.

Lifecycle stage and connectivity: feasibility study, analysis, design, implementation, testing, review or analysis, design, implementation, maintenance, planning; requirements traceability.

Test and integration: building test environments; developing test harnesses; black box/white box testing; incremental testing; acceptance test and integration approaches; changeover strategies, trials and Go-Live prerequisites.

### LO2 Explain the importance of a feasibility study

*Importance of feasibility study:*

Requirement gathering techniques: e.g., interviews, observation, investigation

Key drivers: performance and efficiency; legacy systems upgrade; automation; elimination of human error.

Feasibility criteria: issues e.g. legal, social, economic, technical, timescales; organisational constraints.

Components: purpose; structure; intended audience; outcomes.

Requirements: MosCow; Functional; non-functional; user; constraints.

### LO3 Undertake a software development lifecycle

*Carry out software development lifecycle:*

Identify requirements: stakeholders; requirements identification; requirements specification e.g. scope, inputs, outputs, processes and process descriptors; consideration of alternate solutions and security considerations; quality assurance required.

Constraints: specific to activity e.g. costs, organisational policies, legacy systems, hardware requirements.

Report documentation: structure e.g. background information, problem statements, data collection process and summary, recommendations, appendices.

Systems analysis terminology and tools: data stores and entities; data flows; process representation techniques relationships – 1:1, 1:Many (1:M) and Many:Many (M:M).

Investigation: e.g. upgrading computer systems, designing new systems.

Techniques: examples relevant to methodology chosen e.g. Context Diagrams, Data Flow Diagrams (DFDs), Entity Relationship Diagrams (ERDs); Business Systems Options (BSOs); Technical Systems Options (TSOs); quality considerations e.g. Total Quality Management (TQM).

#### **LO4 Discuss the suitability of software behavioural design techniques**

*Evaluate suitability of software behavioural design techniques:*

Techniques: Flowcharts; Pseudocode; Formal specification Methods; Event/State/Data Driven; Finite State Machines (extended-FSM)/FSP; problem of e-FSM state explosion; reachability analysis, safety, liveness properties; Automatic analysis and animation tools.

## Learning Outcomes and Assessment Criteria

Pass	Merit	Distinction
<b>LO1</b> Describe different software development lifecycles		<b>D1</b> Assess the merits of applying the Waterfall lifecycle model to a large software development project.
<b>P1</b> Describe two iterative and two sequential software lifecycle models.  <b>P2</b> Explain how risk is managed in the Spiral lifecycle model.	<b>M1</b> Describe, with an example, why a particular lifecycle model is selected for a development environment.	
<b>LO2</b> Explain the importance of a feasibility study		<b>D2</b> Assess the impact of different feasibility criteria on a software investigation.
<b>P3</b> Explain the purpose of a feasibility report.  <b>P4</b> Describe how technical solutions can be compared.	<b>M2</b> Discuss the components of a feasibility report.	
<b>LO3</b> Undertake a software development lifecycle		<b>D3</b> Critically evaluate how the use of the function design paradigm in the software development lifecycle can improve software quality.
<b>P5</b> Undertake a software investigation to meet a business need.  <b>P6</b> Use appropriate software analysis tools/techniques to carry out a software investigation and create supporting documentation.	<b>M3</b> Analyse how software requirements can be traced throughout the software lifecycle.  <b>M4</b> Discuss two approaches to improving software quality.	
<b>LO4</b> Discuss the suitability of software behavioural design techniques		<b>D4</b> Present justifications of how data driven software can improve the reliability and effectiveness of software.
<b>P7</b> Explain how user and software requirements have been addressed.	<b>M5</b> Suggest two software behavioural specification methods and illustrate their use with an example.  <b>M6</b> Differentiate between a finite state machine (FSM) and an extended-FSM, providing an application for both.	

## Recommended Resources

### Textbooks

Ferguson, J. (2014) *BDD in Action: Behavior-driven development for the whole software lifecycle*. Manning.

Dennis, A. and Haley, W. (2009) *Systems Analysis and Design*. John Wiley & Sons Ltd.

Lejk, M. and Deeks, D. (2002) *An Introduction to System Analysis Techniques*. 2nd Ed. Addison-Wesley.

Murch, R. (2012) *The Software Development Lifecycle: A Complete Guide*. Kindle.

### Websites

www.freetutes.com	FreeTutes "Systems Analysis and Design – Complete Introductory Tutorial for Software Engineering" (Tutorial)
www.ijcsi.org	IJCSI International Journal of Computer Science Vol. 7, Issue 5, September 2010 "A Comparison Between Five Models Of Software Engineering" (Research)
www.ijcsi.org	IJCSI International Journal of Computer Science Vol. 6, Issue 1, 2015 "Software Development Life Cycle Models – Comparison, Consequences" (Research)

### Links

This unit links to the following related units:

*Unit 6: Managing a Successful Computing Project*

*Unit 13: Computing Research Project*

*Unit 28: Prototyping*

*Unit 30: Application Development*

*Unit 32: Game Design Theory*

*Unit 34: Systems Analysis & Design*

*Unit 47: Games Development*

# **Unit 10: Website Design & Development**

<b>Unit code</b>	<b>R/615/1633</b>
<b>Unit level</b>	<b>4</b>
<b>Credit value</b>	<b>15</b>

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## **Introduction**

Wireless, public hotspots, mobile broadband and unlimited network connections means that accessing and using the internet to request, use and post information has never been so easy, or so important. As public, organisational and business demand increases, so does user expectation. Designers need to successfully use technology to deliver a high quality and consistent User Experiences (UX) through friendly and functional User Interfaces (UI). However, as the software and hardware evolves, so does the challenge of design.

This unit introduces students to the underpinning services required to host, manage and access a secure website before introducing and exploring the methods used by designers and developers to blend back-end technologies (server-side) with front-end technologies (client-side). To help ensure new designers are able to design and deliver a site that offers an outstanding User Experience (UX) supported by an innovative User Interface (UI) this unit also discusses the reasons, requirements, relationships, capabilities and features of the systems they will be using and gives them an opportunity to explore various tools, techniques and technologies with 'good design' principles to plan, design and review a multipage website.

Among the topics included in this unit are: domain structure, domain name systems, web protocols, database servers, development frameworks, website publishing, content management, search engine optimisation, web browsers, HTML standards, CSS and CSS pre-processing (LESS, SASS), presentation models, responsive design, integrated development environments, user requirements, interface design, user experience, branding, navigation, optimisation and validation.

On successful completion of this unit students will be able to explain server technologies and management services associated with the hosting and management of secure websites, categorise website technologies, tools and software used to develop websites, utilise website technologies, tools and techniques with good design principles to create a multipage website and create and use a Test Plan to review the performance and design of a multipage website.

As a result they will develop skills such as communication literacy, critical thinking, analysis, reasoning and interpretation, which are crucial for gaining employment and developing academic competence.

## Learning Outcomes

By the end of this unit students will be able to:

- LO1 Explain server technologies and management services associated with hosting and managing websites.
- LO2 Categorise website technologies, tools and software used to develop websites.
- LO3 Utilise website technologies, tools and techniques with good design principles to create a multipage website.
- LO4 Create and use a Test Plan to review the performance and design of a multipage website.



## Essential Content

### **L01 Explain server technologies and management services associated with hosting and managing websites**

#### *Hosting and website management:*

Investigate relationships between domain names, DNS services and communication protocols used to access a website.

Overview of publishing and managing secure websites, including search engine indexing and ranking.

#### *Different server technologies:*

Differences between web server hardware, software and host operating systems.

Advantages of an integrated database system with regards to expanding website capability.

Common web development technologies and frameworks.

### **L02 Categorise website technologies, tools and software used to develop websites**

#### *Website technologies:*

Using front-end technologies, presentation layers and client-side programming to build a User Interface (UI) and effect User Experience (UX).

How back-end technologies, application layers and server-side programming can be used to enable personalisation and deliver dynamic content.

Tools, techniques and software used to develop websites:

Improving User Experience (UX) through Rich Internet Application (RIA) design using JavaScript and CSS frameworks and packages.

Overview of online content management systems including possible advantages and limitations with regards to design.

Using web design and development software to design and build a secure website.

### **L03 Utilise website technologies, tools and techniques with good design principles to create a multipage website**

#### *Establish the client and user requirements:*

Differentiate client and user requirements from behaviours.

Consider how audience and purpose could influence the look and feel of a website.

Review accessibility standards and guidelines and their possible impact on design and aesthetics.

*Research and create good content combined with good design principles to create a multipage website:*

Introduce and use recognised design principles, incorporating accessibility guidelines to implement an appropriately branded, multipage site.

Discuss why and how the quality of content can affect the performance of a website.

**L04 Create and use a Test Plan to review the performance and design of a multipage website**

*Consider factors that influence website performance:*

Review how intuitive interfaces and actions, user-friendly designs, appropriate graphics, effective navigation and good quality content can help establish user trust and deliver an improved User Experience (UX).

Consider the effects of good and bad search engine optimisation (SEO) and indexing on the performance of a website.

W3C Validation (HTML and CSS) and how it influences website design and performance.

*Establish a Test Plan and use it to assess the performance of a website:*

Assess the impact of poorly optimised website graphics.

Research and conduct Quality Assurance (QA) and usability testing on a multipage website.

## Learning Outcomes and Assessment Criteria

Pass		Merit	Distinction
<b>LO1</b> Explain server technologies and management services associated with hosting and managing websites			<b>LO1 &amp; LO2</b> <b>D1</b> Justify the tools and techniques chosen to realise a custom built website.
<b>P1</b> Identify the purpose and types of DNS, including explanations on how domain names are organised and managed.  <b>P2</b> Explain the purpose and relationships between communication protocols, server hardware, operating systems and web server software with regards to designing, publishing and accessing a website.	<b>M1</b> Evaluate the impact of common web development technologies and frameworks with regards to website design, functionality and management.  <b>M2</b> Review the influence of search engines on website performance and provide evidence-based support for improving a site's index value and rank through search engine optimisation.		
<b>LO2</b> Categorise website technologies, tools and software used to develop websites			
<b>P3</b> Discuss the capabilities and relationships between front-end and back-end website technologies and explain how these relate to presentation and application layers.  <b>P4</b> Discuss the differences between online website creation tools and custom built sites with regards to design flexibility, performance, functionality, User Experience (UX) and User Interface (UI).	<b>M3</b> Evaluate a range of tools and techniques available to design and develop a custom built website.		

Pass	Merit	Distinction
<b>LO3</b> Utilise website technologies, tools and techniques with good design principles to create a multipage website		<b>D2</b> Critically evaluate the design and development process against your design document and analyse any technical challenges.
<b>P5</b> Create a design document for a branded, multipage website supported with medium fidelity wireframes and a full set of client and user requirements.  <b>P6</b> Use your design document with appropriate principles, standards and guidelines to produce a branded, multipage website supported with realistic content.	<b>M4</b> Compare and contrast the multipage website created to the design document.	
<b>LO4</b> Create and use a Test Plan to review the performance and design of a multipage website		<b>D3</b> Critically evaluate the results of your Test Plan and include a review of the overall success of your multipage website; use this evaluation to explain any areas of success and provide justified recommendations for areas that require improvement.
<b>P7</b> Create a suitable Test Plan identifying key performance areas and use it to review the functionality and performance of your website.	<b>M5</b> Evaluate the Quality Assurance (QA) process and review how it was implemented during your design and development stages.	

## Recommended Resources

### Textbooks

Frain, B. (2012) *Responsive Web Design with HTML5 and CSS*. UK: Packt Publishing.

Krug, S. (2013) *Don't Make Me Think: A Common Sense Approach to Web Usability*. USA: New Riders.

Lidwell, W., Holden, K. and Butler, J. (2010) *Universal Principles of Design, Revised and Updated: 115 Ways to Enhance Usability, Influence Perception, Increase Appeal, Make Better Design Decisions and Teach Through Design*. USA: Rockport Publishers.

### Links

This unit links to the following related units:

*Unit 40: User Experience & Interface Design*

# Unit 11: Maths for Computing

**Unit code** D/615/1635

**Unit level** 4

**Credit value** 15

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## Introduction

In 1837 English mathematicians Charles Babbage and Ada Lovelace collaboratively described a machine that could perform arithmetical operations and store data within memory units. This design of their 'Analytical Engine' is the first representation of modern, general-purpose computer technology. Although modern computers have advanced far beyond Babbage and Lovelace's initial proposal, they are still fundamentally relying on mathematics for their design and operation.

This unit introduces students to the mathematical principles and theory that underpin the computing curriculum. Through a series of case studies, scenarios and task-based assessments students will explore number theory within a variety of scenarios; use applicable probability theory; apply geometrical and vector methodology; and finally evaluate problems concerning differential and integral calculus.

Among the topics included in this unit are: prime number theory, sequences and series, probability theory, geometry, differential calculus and integral calculus.

On successful completion of this unit students will be able to gain confidence with the relevant mathematics needed within other computing units. As a result they will develop skills such as communication literacy, critical thinking, analysis, reasoning and interpretation, which are crucial for gaining employment and developing academic competence.

## Learning Outcomes

By the end of this unit students will be able to:

- LO1 Use applied number theory in practical computing scenarios.
- LO2 Analyse events using probability theory and probability distributions.
- LO3 Determine solutions of graphical examples using geometry and vector methods.
- LO4 Evaluate problems concerning differential and integral calculus.

## Essential Content

### L01 Use applied number theory in practical computing scenarios

#### *Number theory:*

Converting between number bases (Denary, Binary, Octal, Duodecimal and Hexadecimal).

Prime numbers, Pythagorean triples and Mersenne primes.

Greatest common divisors and least common multiples.

Modular arithmetic operations.

#### *Sequences and series:*

Expressing a sequence recursively.

Arithmetic and geometric progression theory and application.

Summation of series and the sum to infinity.

### L02 Analyse events using probability theory and probability distributions

#### *Probability theory:*

Calculating conditional probability from independent trials.

Random variables and the expectation of events.

Applying probability calculations to hashing and load balancing.

#### *Probability distributions:*

Discrete probability distribution of the binomial distribution.

Continuous probability distribution of the normal (Gaussian) distribution.

### L03 Determine solutions of graphical examples using geometry and vector methods

#### *Geometry:*

Cartesian co-ordinate systems in two dimensions.

Representing lines and simple shapes using co-ordinates.

The co-ordinate system used in programming output device.

#### *Vectors:*

Introducing vector concepts.

Cartesian and polar representations of a vector.

Scaling shapes described by vector co-ordinates.

#### **L04 Evaluate problems concerning differential and integral calculus**

##### *Differential calculus:*

Introduction to methods for differentiating mathematical functions.

The use of stationary points to determine maxima and minima.

Using differentiation to assess rate of change in a quantity.

##### *Integral calculus:*

Introducing definite and indefinite integration for known functions.

Using integration to determine the area under a curve.

Formulating models of exponential growth and decay using integration methods.



## Learning Outcomes and Assessment Criteria

Pass		Merit	Distinction
<b>LO1</b> Use applied number theory in practical computing scenarios			
<b>P1</b> Calculate the greatest common divisor and least common multiple of a given pair of numbers.  <b>P2</b> Use relevant theory to sum arithmetic and geometric progressions.	<b>M1</b> Identify multiplicative inverses in modular arithmetic.	<b>D1</b> Produce a detailed written explanation of the importance of prime numbers within the field of computing.	
<b>LO2</b> Analyse events using probability theory and probability distributions			
<b>P3</b> Deduce the conditional probability of different events occurring within independent trials.  <b>P4</b> Identify the expectation of an event occurring from a discrete, random variable.	<b>M2</b> Calculate probabilities within both binomially distributed and normally distributed random variables.	<b>D2</b> Evaluate probability theory to an example involving hashing and load balancing.	
<b>LO3</b> Determine solutions of graphical examples using geometry and vector methods			
<b>P5</b> Identify simple shapes using co-ordinate geometry.  <b>P6</b> Determine shape parameters using appropriate vector methods.	<b>M3</b> Evaluate the co-ordinate system used in programming a simple output device.	<b>D3</b> Construct the scaling of simple shapes that are described by vector co-ordinates.	
<b>LO4</b> Evaluate problems concerning differential and integral calculus			
<b>P7</b> Determine the rate of change within an algebraic function.  <b>P8</b> Use integral calculus to solve practical problems involving area.	<b>M4</b> Analyse maxima and minima of increasing and decreasing functions using higher order derivatives.	<b>D4</b> Justify, by further differentiation, that a value is a minimum.	

## Recommended Resources

### Textbooks

Stroud, K. A. (2009) *Foundation Mathematics*. Basingstoke: Palgrave Macmillan.

### Journals

*Journal of Computational Mathematics*. Global Science Press.

### Links

This unit links to the following related units:

*Unit 18: Discrete Maths*

*Unit 22: Applied Analytical Models*

# Unit 12: Data Analytics

**Unit code** K/615/1637

**Unit level** 4

**Credit value** 15

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## Introduction

Like the physical universe, the digital universe is enormous and is doubling in size every two years. By 2020 the digital universe – the data we create and copy annually – is projected to reach 44 zettabytes or 44 trillion gigabytes.

Data is everywhere in the world. Without knowing how to interpret this data it would be difficult to understand its meaning or make use of the data to increase the productivity of an organisation. Data analytics is a range of processes that converts data into actionable insight using a range of statistical techniques. Data analytics is a relatively new term – it is an overarching term for all decision support and problem-solving techniques. Most of the time the term 'data analytics' and 'business analytics' are used interchangeably.

This unit will introduce the theoretical foundation of data analytics and a range of data analytic processes and techniques to provide hands-on experience for enhancing students' skills.

Topics included in this unit are: data analytic terminologies, types of data analytics, data exploration and visualisation, understanding data with descriptive, predictive and prescriptive analytics.

On successful completion of this unit students will be able to understand the theoretical foundation of data analytics, data analytic processes and techniques. Moreover they will gain hands-on experience of implementing data analytic processes and techniques using a programming language such as Python, R, or a tool such as Weka, KNIME, PowerBI, Excel etc.

As a result students will develop skills such as communication literacy, critical thinking, analysis, reasoning and interpretation which are crucial for gaining employment and developing academic competence.

## Learning Outcomes

By the end of this unit students will be able to:

- L01 Discuss the theoretical foundation of data analytics that determine decision-making processes in management or business environments.
- L02 Apply a range of descriptive analytic techniques to convert data into actionable insight using a range of statistical techniques.
- L03 Investigate a range of predictive analytic techniques to discover new knowledge for forecasting future events.
- L04 Demonstrate prescriptive analytic methods for finding the best course of action for a situation.

## Essential Content

### **L01 Discuss the theoretical foundation of data analytics that determine decision-making processes in management or business environments**

*Data analytics terminologies:*

Population, sample, categorical data, nominal data, ordinal data, continuous data, discrete data etc.

Types of data analytics:

Descriptive data analytics, predictive data analytics and prescriptive data analytics.

Exploratory data analysis (EDA):

Variable identification, univariate and bi-variate analysis, missing values treatment, etc.

Data visualisation:

Graphs, charts, plots.

### **L02 Apply a range of descriptive analytic techniques to convert data into actionable insight using a range of statistical techniques**

*Descriptive statistics:*

Measures of central tendency, measure of position and measures of dispersion.

*Probability distribution:*

Cumulate distribution, discrete distribution, continuous distribution.

Sampling and estimation:

Random sampling, systematic sampling, point estimate, interval estimate and so forth.

Statistical inferences:

Models and assumptions.

### **L03 Investigate a range of predictive analytic techniques to discover new knowledge for forecasting future events**

*Regression analytics:*

Linear regression, multiple linear regression and logistic regression.

*Forecasting techniques:*

Qualitative, average approach, naïve approach, time series methods, causal relationship and so forth.

**L04 Demonstrate prescriptive analytic methods for finding the best course of action for a situation**

*Optimisation:*

Classical optimisation, linear programming techniques, nonlinear programming techniques, dynamic programming.

*Decision analysis:*

Models, justifiable decisions and defensible decisions.

## Learning Outcomes and Assessment Criteria

Pass		Merit	Distinction
<b>LO1</b> Discuss the theoretical foundation of data analytics that determine decision-making processes in management or business environments			<b>LO1 &amp; LO2</b>  <b>D1</b> Apply an appropriate programming language or tool to demonstrate how these descriptive analytic techniques contribute to decision-making.
<b>P1</b> Identify data analytic activities, techniques, and tools.  <b>P2</b> Demonstrate an ability to use a popular programming language or tool used in the data analytics industry.	<b>M1</b> Investigate the three types of data analytic methods and their use in industry.		
<b>LO2</b> Apply a range of descriptive analytic techniques to convert data into actionable insight using a range of statistical techniques			
<b>P3</b> Investigate descriptive analytic techniques and explain with appropriate examples.  <b>P4</b> Apply an appropriate tool or programming language to demonstrate these descriptive analytics techniques.	<b>M2</b> Show how these descriptive analytic techniques contribute to decision-making.		
<b>LO3</b> Investigate a range of predictive analytic techniques to discover new knowledge for forecasting future events			<b>D2</b> Apply an appropriate programming language or tool to demonstrate how these predictive analytic techniques are used in forecasting future events.
<b>P5</b> Identify predictive analytic techniques and describe these techniques with examples.  <b>P6</b> Apply an appropriate tool or programming language to demonstrate these predictive analytic techniques.	<b>M3</b> Explain how these predictive analytic techniques are used for forecasting.		

Pass	Merit	Distinction
<b>LO4</b> Demonstrate prescriptive analytic methods for finding the best course of action for a situation		<b>D3</b> Apply an appropriate programming language or tool to demonstrate how these prescriptive analytic techniques are used to find the best course of action in a situation.
<b>P7</b> Analyse prescriptive analytic techniques with appropriate examples. <b>P8</b> Demonstrate these techniques using an appropriate programming language or tool.	<b>M4</b> Describe how these prescriptive analytic techniques are used to find the best course of action in a situation.	

## Recommended Resources

### Textbooks

Evans, J. (2016) *Business Analytics*. 2nd Ed. Pearson.

Runkler, T. (2016) *Data Analytics: Models and Algorithms for Intelligent Data Analysis*. 2nd Ed. Vieweg+Teubner Verlag.

### Websites

<a href="http://archive.ics.uci.edu/ml">archive.ics.uci.edu/ml</a>	University of California, Irvine "Machine Learning Repository" (Data sets)
<a href="http://www.lfd.uci.edu">www.lfd.uci.edu</a>	University of California, Irvine – Laboratory for Fluorescence Dynamics "Binaries for Python Extension Packages" (Development Tool)
<a href="http://cran.r-project.org">cran.r-project.org</a>	The R Project for Statistical Computing "R Archive Network" (Development Tool)
<a href="http://www.cs.waikato.ac.nz">www.cs.waikato.ac.nz</a>	University of Waikato – Machine Learning Group "Data Mining Software in Java" (Development Tool)
<a href="http://www.knime.org">www.knime.org</a>	Konstanz Information Miner "KNIME" (Development Tool)
<a href="http://powerbi.microsoft.com">powerbi.microsoft.com</a>	Microsoft Power BI "Power BI Desktop" (Development Tool)

### Links

This unit links to the following related units:

*Unit 14: Business Intelligence*

*Unit 21: Data Mining*



# **Unit 13:                      Computing Research Project**

<b>Unit code</b>	<b>T/615/1639</b>
<b>Unit type</b>	<b>Core</b>
<b>Unit level</b>	<b>5</b>
<b>Credit value</b>	<b>30</b>

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## **Introduction**

This unit is assessed by a Pearson-set assignment. Students will choose their own project based on a theme provided by Pearson (this will change annually). The project must be related to their specialist pathway of study (unless the student is studying the general computing pathway). This will enable students to explore and examine a relevant and current topical aspect of computing in the context of a business environment and their chosen specialist pathway.

The aim of this unit is to offer students the opportunity to engage in sustained research in a specific field of study. The unit enables students to demonstrate the capacity and ability to identify a research theme, to develop research aims, objectives and outcomes, and to present the outcomes of such research in both written and verbal formats. The unit also encourages students to reflect on their engagement in the research process during which recommendations for future, personal development are key learning points.

On successful completion of this unit students will have the confidence to engage in problem-solving and research activities which are part of the function of a manager. Students will have the fundamental knowledge and skills to enable them to investigate workplace issues and problems, determine appropriate solutions and present evidence to various stakeholders in an acceptable and understandable format.

As a result they will develop skills such as communication literacy, critical thinking, analysis, synthesis, reasoning and interpretation which are crucial for gaining employment and developing academic competence.

## **Learning Outcomes**

By the end of this unit students will be able to:

- LO1    Examine appropriate research methodologies and approaches as part of the research process.
- LO2    Conduct and analyse research relevant to a computing research project.
- LO3    Communicate the outcomes of a research project to identified stakeholders.
- LO4    Reflect on the application of research methodologies and concepts.

## Essential Content

### L01 **Examine appropriate research methodologies and approaches as part of the research process**

#### *Developing a research proposition:*

The importance of developing methodical and valid propositions as the foundation for a research project.

Rationale: the purpose and significance for research question or hypothesis.

The value of the philosophical position of the researcher and the chosen methods.

Use of Saunders's research onion as a guide to establishing a methodological approach.

#### *Literature review:*

Conceptualisation of the research problem or hypothesis.

The importance of positioning a research project in context of existing knowledge.

Significance and means of providing benchmarks by which data can be judged.

#### *Qualitative, quantitative and mixed method research:*

Key theoretical frameworks for research.

Advantages and limitations of qualitative and quantitative research approaches and methods.

### L02 **Conduct and analyse research relevant for a business research project**

#### *Research as a process:*

Research has distinct phases which support a coherent and logical argument. This includes using secondary research to inform a primary, empirical, study.

#### *Selecting a sample:*

The importance of gathering data and information (qualitative or quantitative) to support research analysis.

Selecting sample types and sizes that are relevant to the research.

Considering sampling approaches and techniques, including probability and non-probability sampling.

#### *Ethics, reliability and validity:*

Research should be conducted ethically. How is this achieved and reported?

Research should also be reliable (similar results would be achieved from a similar sample) and valid (the research measures what it aimed to measure).

*Analysing data:*

Using data collection tools such as interviews and questionnaires.

Using analytical techniques such as trend analysis, coding or typologies.

### **L03 Communicate the outcomes of a research project to identified stakeholders**

*Stakeholders:*

Who are they?

Why would they be interested in the research outcomes?

What communication method do they expect?

*Communicating research outcomes:*

Consideration of different methods of communicating outcomes (e.g. written word, spoken word) and the medium (e.g. report, online, presentation). The method and medium will be influenced by the research and its intended audience.

*Convincing arguments:*

No matter what the method/medium, all research should be convincing and presented logically where the assumption is that the audience has little or no knowledge of the research process.

The importance of developing evaluative conclusions.

### **L04 Reflect on the application of research methodologies and concepts**

*Reflection for learning and practice:*

Difference between reflecting on performance and evaluating a research project. The former considers the research process; the latter considers the quality of the research argument and use of evidence.

Reflection on the merits, limitations and potential pitfalls of the chosen methods.

*The cycle of reflection:*

To include reflection in action and reflection on action.

Considering how to use reflection to inform future behaviour and future considerations.

*Reflective writing:*

Avoiding generalisation and focusing on personal development and the research journey in a critical and objective way.

## Learning Outcomes and Assessment Criteria

Pass		Merit	Distinction
<b>LO1</b> Examine appropriate research methodologies and approaches as part of the research process			<b>LO1 &amp; LO2</b> <b>D1</b> Critically evaluate research methodologies and processes in application to a computing research project to justify chosen research methods and analysis.
<b>P1</b> Produce a research proposal that clearly defines a research question or hypothesis supported by a literature review.  <b>P2</b> Examine appropriate research methods and approaches to primary and secondary research.	<b>M1</b> Evaluate different research approaches and methodology and make justifications for the choice of methods selected based on philosophical/theoretical frameworks.		
<b>LO2</b> Conduct and analyse research relevant for a business research project			
<b>P3</b> Conduct primary and secondary research using appropriate methods for a computing research project that consider costs, access and ethical issues.  <b>P4</b> Apply appropriate analytical tools, analyse research findings and data.	<b>M2</b> Discuss merits, limitations and pitfalls of approaches to data collection and analysis.		
<b>LO3</b> Communicate the outcomes of a research project to identified stakeholders			<b>D2</b> Communicate critical analysis of the outcomes and make valid, justified recommendations.
<b>P5</b> Communicate research outcomes in an appropriate manner for the intended audience.	<b>M3</b> Coherently and logically communicate outcomes to the intended audience demonstrating how outcomes meet set research objectives.		

Pass	Merit	Distinction
<b>LO4</b> Reflect on the application of research methodologies and concepts		<b>D3</b> Demonstrate reflection and engagement in the resource process leading to recommended actions for future improvement.
<b>P6</b> Reflect on the effectiveness of research methods applied for meeting objectives of the computing research project.  <b>P7</b> Consider alternative research methodologies and lessons learnt in view of the outcomes.	<b>M4</b> Provide critical reflection and insight that results in recommended actions for improvements and future research considerations.	

## Recommended Resources

### Textbooks

Cornford, T. (2005) *Project Research in Information Systems: A Student's Guide*. Paperback. Macmillan.

Costley, C., Elliot, G. and Gibbs, P. (2010) *Doing Work Based Research: Approaches to Enquiry for Insider-researchers*. London: SAGE.

Fink, A. (2009) *Conducting Research Literature Reviews: From the Internet to Paper*. 3rd Ed. Sage Inc.

Flick, U. (2011) *Introducing Research Methodology: A Beginner's Guide to Doing a Research Project*. London: SAGE.

Gray, D. (2009) *Doing Research in the Real World*. 2nd Ed. London: SAGE.

Saunders, M, Lewis, P and Thornhill, A. (2012) *Research methods for Business Students*. 6th Ed. Harlow: Pearson.

Wellington, J. (2000) *Educational Research: Contemporary Issues and Practical Approaches*. Continuum International Publishing Group Ltd.

### Journals

*International Journal of Quantitative and Qualitative Research*

*Qualitative Research Journal*

### Links

This unit links to the following related units:

*Unit 3: Professional Practice*

*Unit 6: Managing a Successful Computing Project*

*Unit 9: Software Development Lifecycles*

# **Unit 14: Business Intelligence**

**Unit code** M/615/1641

**Unit type** Core

**Unit level** 5

**Credit value** 15

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## **Introduction**

Data and information is core to any organisation and business process. The necessity of having meaningful information is the key driver for effective decision-making and problem-solving. Business intelligence has evolved from technologies such as decision support systems (DSS) to include tools and methods associated with data mining, data integration, data quality and data warehousing in conjunction with other information management systems and applications.

This unit introduces students to a range of tools, techniques and technologies for acquiring data and processing this into meaningful information that can be used to support business functions and processes.

Within this unit students will examine the concept of business processing in terms of data capture, conversion and information output. Students will also be required to define the tools and technologies associated with business intelligence functionality. The use of a business intelligence tool/s and techniques is also required to demonstrate an understanding of a given problem. Finally, students will be expected to evaluate the impact of business intelligence for effective decision-making.

On successful completion of this unit students will be able to appreciate the importance of business intelligence in terms of optimising decision-making and performance. By exploring the tools, techniques and systems that support business intelligence students will have an awareness of the role and contribution that these technologies and methodologies have and their importance to organisations.

As a result students will develop skills such as communication literacy, critical thinking, analysis, reasoning and interpretation, which are crucial for gaining employment and developing academic competence.

## **Learning Outcomes**

By the end of this unit students will be able to:

- LO1 Discuss business processes and the mechanisms used to support business decision-making.
- LO2 Compare the tools and technologies associated with business intelligence functionality.
- LO3 Demonstrate the use of business intelligence tools and technologies.
- LO4 Discuss the impact of business intelligence tools and technologies for effective decision-making purposes and the legal/regulatory context in which they are used.

## Essential Content

### L01 **Discuss business processes and the mechanisms used to support business decision-making**

#### *Business process model:*

Data input and capture, data processing/conversion and information output, security considerations; unstructured and semi-structured data.

Tactical and operational decisions, the business process model, business intelligence functionality.

Analyse and compare the systems and technologies associated with business intelligence.

#### *Mechanisms:*

Application software, databases, which are used to collect and store intelligence.

Systems that are used to manage, analyse and display business intelligence to support the decision-making process; the importance of reliable data; impacts of reliable data in businesses.

#### *Business processes:*

Management e.g. supporting decision-making, problem-solving; operational e.g. sales, purchasing and marketing; support e.g. accounting, technical supporting processes; improving the efficiency of a business process e.g. forecasting, decision-making, predictive reasoning; automating processes e.g. print runs, salary slips etc.

### L02 **Compare the tools and technologies associated with business intelligence functionality**

#### *Support for business decisions:*

Operational tactical and strategic. Operational examples could include product positioning or pricing. Tactical decisions could include financial outlays to gain competitive advantage. Strategic business decisions could include priorities, goals setting and forecasting for the future, global diversification etc.

#### *Business intelligence functionality:*

Analysing data, decision-making, problem-solving, designing more intuitive/innovative systems.

#### *Systems and technologies:*

Information systems at an operational, tactical and strategic level. Transaction processing, management information systems, decision support systems, expert systems.



### **L03 Demonstrate the use of business intelligence tools and technologies**

#### *Tools and techniques:*

Descriptive and predictive analysis, predictive modelling e.g. forecasting, use of statistical models to predict and identify trends. Data mining techniques to find anomalies, cluster patterns and/or relationships between data sets. Converting data into visual information using charts, graphs, histograms and other visual mediums.

#### *Solutions:*

Supporting a business process e.g. end user requirements, systems requirement, application to automate procedures. Designing a tool, program or package that can perform a specific task to support problem-solving or decision-making at an advanced level.

#### *Uses:*

For example, designing an application to solve a specific user need or system requirement. Create an e-commerce function for a website to support a specific business process, design a program for a specific end user that will support another application or process.

#### *Design considerations:*

Addressing a user or system requirement; designing a user-friendly and functional interface; considering user engagement and interaction with the designed solution; customisation of the solution to satisfy the user and system requirements.

### **L04 Discuss the impact of business intelligence tools and technologies for effective decision-making purposes and the legal/regulatory context in which they are used**

Recognise the legal, social, ethical and professional issues involved in the exploitation of computer technology.

#### *Cybersecurity management:*

Understanding the personal, organisational and legal/regulatory context in which these tools could be used, the risks of such use and the constraints (such as time, finance and people) that may affect how cybersecurity is implemented.

#### *Evaluation criteria:*

Enhanced or improved operations e.g. more efficient, faster results, more user-friendly, higher productivity, extended target audience, more competitive, more profitable, improved customer service.

## Learning Outcomes and Assessment Criteria

Pass		Merit	Distinction
<b>LO1</b> Discuss business processes and the mechanisms used to support business decision-making			<b>D1</b> Evaluate the benefits and drawbacks of using application software as a mechanism for business processing.
<b>P1</b> Examine, using examples, the terms 'Business Process' and 'Supporting Processes'.	<b>M1</b> Differentiate between unstructured and semi-structured data within an organisation.		
<b>LO2</b> Compare the tools and technologies associated with business intelligence functionality			<b>D2</b> Compare and contrast a range of information systems and technologies that can be used to support organisations at operational, tactical and strategic levels.
<b>P2</b> Compare the types of support available for business decision-making at varying levels within an organisation.	<b>M2</b> Justify, with specific examples, the key features of business intelligence functionality.		
<b>LO3</b> Demonstrate the use of business intelligence tools and technologies			<b>D3</b> Provide a critical review of the design in terms of how it meets a specific user or business requirement and identify what customisation has been integrated into the design.
<b>P3</b> Determine, with examples, what business intelligence is and the tools and techniques associated with it.  <b>P4</b> Design a business intelligence tool, application or interface that can perform a specific task to support problem-solving or decision-making at an advanced level.	<b>M3</b> Customise the design to ensure that it is user-friendly and has a functional interface.		

Pass	Merit	Distinction
<p><b>L04</b> Discuss the impact of business intelligence tools and technologies for effective decision-making purposes and the legal/regulatory context in which they are used</p>		<p><b>D4</b> Evaluate how organisations could use business intelligence to extend their target audience and make them more competitive within the market, taking security legislation into consideration.</p>
<p><b>P5</b> Discuss how business intelligence tools can contribute to effective decision-making.</p> <p><b>P6</b> Explore the legal issues involved in the secure exploitation of business intelligence tools.</p>	<p><b>M4</b> Conduct research to identify specific examples of organisations that have used business intelligence tools to enhance or improve operations.</p>	

## Recommended Resources

### Textbooks

Boyer, J. (2010) *Business Intelligence Strategy*. MC Press (US).

Jeston, J. and Nelis, J. (2014) *Business Process Management*. 3rd Ed. Routledge.

Kolb, J. (2013) *Business Intelligence in Plain Language: A practical guide to Data Mining and Business Analytics*. CreateSpace Independent Publishing Platform.

Marr, B. (2015) *Big Data: Using Smart Big Data, Analytics and Metrics to Make Better Decisions and Improve Performance*. 1st Ed. John Wiley & Sons, Ltd.

### Journals

*International Journal of Business Intelligence and Data Mining*

*International Journal of Business Intelligence Research (IJBIR)*

### Websites

businessintelligence.com	Business Intelligence (General Reference)
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business-intelligence.ac.uk	Business Intelligence Project for HE (General Reference)
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### Links

This unit links to the following related units:

*Unit 6: Managing a Successful Computing Project*

*Unit 12: Data Analytics*

*Unit 22: Applied Analytical Models*

*Unit 33: Analytical Methods*

# **Unit 15: Transport Network Design**

<b>Unit code</b>	<b>T/615/1642</b>
<b>Unit level</b>	<b>5</b>
<b>Credit value</b>	<b>15</b>

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## **Introduction**

The exponential growth of the World Wide Web has put unprecedented demands on private and public networking infrastructures. The traffic generated by private and commercial networks has become dominated by Voice-over-IP and video on demand. These developments require existing infrastructures to be adapted and that the design of new networks mitigate best-effort delivery issues, avoid low bandwidths and high latency problems and be based on traffic priority. In order for enterprise networks and internet infrastructures to meet expected demands, their design will have to take into consideration principles such as availability, scalability, resiliency, reliability and quality of service (QoS). As a result, network engineers designing and supporting enterprise or Internet Service Provider networks will need the knowledge and skills to support diverse business needs, such as converged network traffics, centralised control and mission-critical applications.

This unit introduces students to the enterprise network design principles, design models, scalable networks and their effectiveness in supporting business requirements. After evaluating the features of scalable networks, such as availability, reliability and hierarchy, the students are expected to apply network design principles in the design and implementation of redundant networks to provide Layer 2 and Layer 3 redundant solutions. The students are also expected to evaluate Wide Area Network (WAN) technologies and make choices based on specific enterprise requirements, and to implement a range of WAN connections and protocols such as Point-to-Point, Frame Relay and VPN with IPSec using network simulators or network lab equipment. In addition, they will also solve network-related issues using network monitoring and troubleshooting methods and techniques.

Among the topics included in this unit are: network design principles, network design modules, features of enterprise IT networks, such as scalability, reliability, availability and hierarchy, LAN redundancy and related issues, spanning tree protocols, router redundancy protocols, link aggregation, in-band and out-of-band network device management, features and characteristics of WAN networks, WAN technologies and protocols, such as PPP, Frame Relay and VPN with IPSec, network monitoring tools, Network Security, network documentation, network troubleshooting methods and LAN and WAN connectivity issues.

On successful completion of this unit students will be able to evaluate LAN design principles and their application in the network design process, implement a network using LAN design principles based on a predefined set of requirements, produce an appropriate WAN solution to a set of organisational requirements and solve a range of network-related problems using appropriate troubleshooting techniques and methods.

As a result they will develop skills such as communication literacy, critical thinking, analysis, reasoning and interpretation, which are crucial for gaining employment and developing academic competence.

## **Learning Outcomes**

By the end of this unit students will be able to:

- LO1 Explore LAN design principles and their application in the network design process.
- LO2 Implement a network using LAN design principles based on a predefined set of requirements.
- LO3 Produce an appropriate WAN solution to a set of organisational requirements.
- LO4 Solve a range of network related problems using appropriate troubleshooting techniques and methods.

## Essential Content

### L01 Explore LAN design principles and their application in the network design process

*Discuss and evaluate LAN design principles based on business needs:*

Analysing diverse business needs: support critical applications, support converged network traffic, centralised administrative control.

Network features: bandwidth, delay, load.

*Evaluate LAN design models:*

Review of OSI and TCP/IP models, three-layer design model, enterprise architecture design model, features of scalable networks (redundancy, hierarchy, scalability, availability, reliability and small failure domains).

*Analyse LAN redundancy:*

Issues related to redundancy, spanning tree concepts, Spanning Tree Protocols.

*Solving bandwidth and load related issues:*

Examine link aggregation concepts and operations, configure link aggregation using EtherChannel technology.

*Evaluate the need for redundancy at router level:*

Default Gateway related issues, router redundancy protocols.

### L02 Implement a network using LAN design principles based on a predefined set of requirements

*Application of LAN design principles in network design and configuration:*

Selecting network devices to implement a LAN design: use modularity, stackability, port density, multi-layer switching and router requirements in the selection process.

*Configuring LAN devices:*

Compare out-of-band and in-band management, evaluate user interfaces, examine operating system management and licencing issues, basic device configuration.

*Implementing Layer 2 LAN redundancy:*

Configuration of different Spanning Tree Protocols (STP and Rapid STP).

*Implementing Layer 3 LAN redundancy for IPv4:*

Configuring First Hop Redundancy Protocols (Hot Standby Routing Protocol, Virtual Router Redundancy Protocol and Gateway Load Balancing Protocol).

*Implementing Layer 3 LAN redundancy for IPv6:*

Configuring the 'new generation' of redundancy routing protocols.

### **LO3 Produce an appropriate WAN solution to a set of organisational requirements**

*WAN networks and protocols:*

Analyse features and requirements of enterprise networks: analyse WAN enterprise architecture, uptime, bandwidth, ISPs, traffic flows, prioritisation, queuing, latency, QoS, teleworking.

*WAN Technologies:*

Examine WAN operations and services, analyse and compare private and public WAN technologies, select the appropriate WAN protocol and service for a specific network requirement.

*WAN serial connections:*

Configuring Point-to-Point connections using Point-to-Point Protocol (PPP): explain point-to-point serial WAN serial communication, analyse and configure HDLC, analyse and configure PPP.

*Configuring Frame Relay:*

Analyse and compare Frame Relay and leased lines benefits and drawbacks, explain Frame Relay protocol Permanent Virtual Circuits (PVC), Link Management Interface (LMI) extensions, Data Link Connection Identifier (DLCI) mappings, configure static Frame Relay, implement advanced Frame Relay configurations.

*VPN over a public infrastructure connection:*

Explaining Virtual Private Network (VPN) features and benefits, compare VPN types, configure site-to-site secure tunnel connections, configure VPN with IP Security (IPSec) and compare IPSec and SSL VPNs (Secure Socket Layer).

### **LO4 Solve a range of network related problems using appropriate troubleshooting techniques and methods**

*Network Security considerations:*

Network Security issues, their impacts and solutions.



*Network monitoring and troubleshooting methods:*

Network monitoring tools: analyse, compare and configure Syslog, Network Time Protocol (NTP), NetFlow and Simple Network Management Protocol (SNMP).

Network troubleshooting: establishing network baselines, troubleshooting methods with a systematic approach, gathering information, questioning end users, preparing network documentation, comparing network troubleshooting tools.

*Troubleshooting LAN and WAN connectivity issues:*

Physical and Data Link layers networking issues and troubleshooting: examine cable faults, device failures, bottlenecks, congestions, attenuation, noise, power issues (redundant power supplies), encapsulation mismatches, STP related issues, etc.

*Network layer issues and troubleshooting:*

Evaluate divide and conquer method, importance of ipconfig, ping and traceroute commands, subnetting issues, troubleshooting routing protocols, PPP, Frame Relay and VPN configuration issues.

*Transport and Application layers networking issues and troubleshooting:*

Examine the use of port numbers in Access Control Lists, denying and allowing errors, ACL misconfigurations, NAT, DNS and DHCP related issues.

## Learning Outcomes and Assessment Criteria

Pass		Merit	Distinction
<b>LO1</b> Explore LAN design principles and their application in the network design process			<b>LO1 &amp; LO2</b>  <b>D1</b> Evaluate different implementations of link aggregation using EtherChannel to solve bandwidth and load issues.
<b>P1</b> Examine the network design models and features of scalable networks based on a given set of business needs.  <b>P2</b> Discuss LAN redundancy, bandwidth and load related issues and possible solutions with reference to Layer 2 and Layer 3 of the OSI Model.	<b>M1</b> Analyse the switch and router redundancy protocols and their effectiveness in supporting scalable networks.		
<b>LO2</b> Implement a network using LAN design principles based on a predefined set of requirements			
<b>P3</b> Select LAN devices based on features and requirements, and apply basic configuration commands for network connectivity.  <b>P4</b> Implement a LAN design with Layer 2 and Layer 3 redundancy using switch and router redundancy protocols.	<b>M2</b> Analyse different switch redundancy protocols and their effectiveness in solving redundancy issues.  <b>M3</b> Analyse Layer 3 redundancy implementations for IPv4 and IPv6.		

Pass	Merit	Distinction
<b>LO3</b> Produce an appropriate WAN solution to a set of organisational requirements		<b>LO3 &amp; 4</b>  <b>D2</b> Evaluate troubleshooting methods and their effectiveness in solving enterprise-wide networking issues.
<b>P5</b> Examine WAN technologies and select the appropriate one for a set of enterprise requirements.  <b>P6</b> Configure WAN protocols as part of an enterprise network solution.	<b>M4</b> Analyse the benefits and drawbacks of private and public WAN technologies.  <b>M5</b> Evaluate features and benefits of different VPN types based on organisational needs.	
<b>LO4</b> Solve a range of network related problems using appropriate troubleshooting techniques and methods		
<b>P7</b> Deploy network monitoring tools and troubleshooting methods to establish network baselines and produce network documentation.  <b>P8</b> Troubleshoot LAN and WAN connectivity issues at different networking layers.	<b>M6</b> Develop effective documentation of troubleshooting methods and steps based on a given scenario.	

## Recommended Resources

### Textbooks

Meyers, M. (2015) *CompTIA Network+ Guide to Managing and Troubleshooting Networks, Fourth Edition*. London, UK: McGraw Hill Professional.

Subramanian, M. (2012) *Network Management: Principles and Practices*. USA: Prentice Hall.

Thomatis, M. (2015) *Network Design Cookbook: Architecting Cisco Networks*. USA: Lulu Press, Inc.

White, R. and Donohue, D. (2014) *The Art of Network Architecture: Business-Driven Design*. USA: Cisco Press.

### Links

This unit links to the following related units:

*Unit 2: Networking*

*Unit 8: Computer Systems Architecture*

*Unit 17: Network Security*

*Unit 35: Network Management*

*Unit 36: Client/Server Computing Systems*

# Unit 16: Cloud Computing

**Unit code** F/615/1644

**Unit level** 5

**Credit value** 15

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## Introduction

Cloud Computing has revolutionised the way IT services are delivered and has become an important part of the computing sector. Cloud Computing is internet-hosted computing, which means it uses the internet to deliver data and other IT services such as storage, printing, server facilities and so forth. In other words, the end users or organisations no longer need to have their own extensive network environment on the premises, but can get the same services provided virtually over the internet.

The fundamental difference between traditional networking and Cloud Computing is that the technical details of the system are hidden from the end user. That means the networking infrastructure does not have to be on the premises as it would be hosted off-site in the cloud. However, the end user can use the services without the fear of technical difficulties or disasters as it would be managed by the cloud service provider. Cloud Computing is a natural evolution of networking and is adapting the modern network-oriented technologies such as virtualisation, service-oriented architecture, utility computing and ubiquitous computing among others.

This unit is designed to develop an understanding of the fundamental concept of Cloud Computing, cloud segments, and cloud deployment models, the need for Cloud Computing, an appreciation of issues associated with managing cloud service architecture and to develop a critical awareness of Cloud Computing based projects.

Topics included in the unit are the paradigms of networking, fundamentals of Cloud Computing, Cloud Computing architecture, deployment models, service models, security, technological drivers, and cloud service providers.

On successful completion of this unit, students will understand the concept, architecture, and services of Cloud Computing and will gain hands-on experience of configuring a cloud service from major providers such as ECM, Google, Amazon, Microsoft, IBM etc., and implementing a simple cloud platform using open source software with an appropriate networking platform.

As a result students will develop skills such as communication literacy, critical thinking, analysis, reasoning and interpretation, which are crucial for gaining employment and developing academic competence.

## Learning Outcomes

By the end of this unit students will be able to:

- LO1. Demonstrate an understanding of the fundamentals of Cloud Computing and its architectures.
- LO2. Evaluate the deployment models, service models and technological drivers of Cloud Computing and validate their use.

- LO3. Develop Cloud Computing solutions using service provider's frameworks and open source tools.
- LO4. Analyse the technical challenges for cloud applications and assess their risks.

## Essential Content

### **L01 Demonstrate an understanding of the fundamentals of Cloud Computing and its architectures**

Networking Paradigm: Peer-to-peer Computing, Client-Server Computing, Distributed Computing, Cluster Computing, High-Performance Computing, Parallel Computing, Grid Computing

Cloud Computing Fundamentals: What is cloud computing? Definition of Cloud Computing, Principles of Cloud Computing, Cloud Ecosystem, Cloud Architecture, Network Connectivity in Cloud Computing, Managing the Cloud, Migrating Application to Cloud

### **L02 Evaluate the deployment models, service models and technological drivers of Cloud Computing and validate their use**

*Deployment models:*

Private Cloud, Public Cloud, Community Cloud, Hybrid Cloud.

*Service models:*

IaaS, PaaS, SaaS, AaaS.

*Technological drivers:*

SOA, Virtualisation, Multicore Technology, Memory and Storage Technology, Networking Technology, Web 2.0, & 3.0, Software Process Models for Cloud, Programming Models, Pervasive Computing, Application Environment.

### **L03 Develop Cloud Computing solutions using service provider's frameworks and open source tools**

*Cloud Service Providers:*

EMC, Google, Amazon Web Services, Microsoft, IBM, VMware.

*Open Source:*

Open Source Tools for IaaS, Open Source Tools for PaaS, Open Source Tools for SaaS, Distributed Computing Tools: Cassandra, Hadoop, MongoDB, NGrid, Ganglia.

**L04 Analyse the technical challenges for cloud applications and assess their risks**

*Security aspects:*

Data Security, Virtualisation, Network Security.

*Platform related security:*

SaaS Security issues, PaaS Security Issues, IaaS Security Issues, Audit and Compliance.



## Learning Outcomes and Assessment Criteria

Pass		Merit	Distinction
<b>LO1</b> Demonstrate an understanding of the fundamentals of Cloud Computing and its architectures			<b>LO1 &amp; LO2</b>  <b>D1</b> Justify the tools chosen to realise a Cloud Computing solution.
<b>P1</b> Analyse the evolution and fundamental concepts of Cloud Computing.  <b>P2</b> Design an appropriate architectural Cloud Computing framework for a given scenario.	<b>M1</b> Discuss why an organisation should migrate to a Cloud Computing solution.		
<b>LO2</b> Evaluate the deployment models, service models and technological drivers of Cloud Computing and validate their use			
<b>P3</b> Define an appropriate deployment model for a given scenario.  <b>P4</b> Compare the service models for choosing an adequate model for a given scenario.	<b>M2</b> Demonstrate these deployment models with real world examples.		
<b>LO3</b> Develop Cloud Computing solutions using service provider's frameworks and open source tools			
<b>P5</b> Configure a Cloud Computing platform with a cloud service provider's framework.  <b>P6</b> Implement a cloud platform using open source tools.	<b>M3</b> Discuss the issues and constraints one can face during the development process.		<b>D2</b> Critically discuss how one can overcome these issues and constraints.

Pass	Merit	Distinction
<b>L04</b> Analyse the technical challenges for cloud applications and assess their risks		<b>D3</b> Critically discuss how an organisation should protect their data when they migrate to a cloud solution.
<b>P7</b> Analyse the most common problems which arise in a Cloud Computing platform and discuss appropriate solutions to these problems.  <b>P8</b> Assess the most common security issues in cloud environments.	<b>M4</b> Discuss how to overcome these security issues when building a secure cloud platform.	

## Recommended Resources

### Textbooks

Chandrasekaran, K. (2015) *Essentials of Cloud Computing*, CRC Press.

Kapadia, A., Varma, S. and Rajana, K. (2014) *Implementing Cloud Storage with OpenStack*. Packt Publishing.

Patawari, A. (2013) *Getting Started with own Cloud*. Packt Publishing.

Rhoton, J. and De Clercq, J. (2014) *OpenStack Cloud Computing: Architecture*, Recursive Press.

Thomas Eri, T. and Ricardo Puttin, R. (2013) *Cloud Computing: Concept, Technology and Architecture*. Prentice Hall.

Zhu, S-Y. and Hill, R. (2016) *Guide to Security Assurance for Cloud Computing*, Springer.

### Links

This unit links to the following related units:

*Unit 48: Systems Integration*

# Unit 17: Network Security

**Unit code** L/615/1646

**Unit level** 5

**Credit value** 15

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## Introduction

"Who is accessing my network?" A bank was hacked last week? Did you hear about that? Last night I blocked my neighbours from accessing their internet because they did not have a Wireless Equivalent Protection (WEP) or WPA (Wi-Fi Protected Access) key on their wireless."

It is estimated that Network Security (NS) breaches occur every second worldwide from small home networks to massive corporate networks. The cost to businesses is in billions, if not trillions. There are several methods, techniques and procedures that need to be implemented on a network in order for it to be 'secure'. Sometimes basic procedures such as locking your network room, changing your password regularly, as well as putting a password on all your network devices, is all that is needed to achieve some basic network security.

This unit introduces students to the fundamental principles of Network Security practices. As Systems Administration and Management are important tasks in the day-to-day functioning and security of Information Systems, poor or improper practices can lead to loss of data, its integrity, performance reductions, security breaches or total system failure. Special planning and provisions needs to be made for ongoing support of systems and networks, which account for a significant proportion of the IT budget. With the widespread use of computers and the internet for business customers and home consumers, the topic of security continues to be a source for considerable concern.

Among the topics included in this unit are: historical Network Security (NS) principles and associated aspects such as Firewalls, Routers, Switches, MD5, SSL, VPN, AES, SHA-1/2, RSA, DES, 3DES; different types of public and private key cryptography such as Caesar Cipher, IPSec; types of attacks that can be done on a network and methods of preventing such attacks such as Man-In-the-Middle (eavesdropping), Denial of Service (DoS), Distributed Denial of Service (DDoS) (ping); Certificate Authority (CA); 'The Cloud' Security aspects and associated counter-measures such Public Cloud, Private Cloud, Hybrid Cloud, Community Cloud, Platform-as-a-Service (PaaS), Infrastructure-as-a-Service (IaaS), phishing, spoofing, DNS attack, SQL Injection, MAC Address spoofing/control. Firewalls and other Gateways can be used as a tool for Intrusion Detection and Prevention as they can be situated on the perimeter of the Network to provide security.

On successful completion of this unit students will be able to discuss with confidence several types of Network Security measures as well as associated protocols, cryptographic types and configuration settings of Network Security environments. Finally, students will be able to test the security of a given network to identify and fix vulnerabilities.

As a result they will develop skills such as communication literacy, critical thinking, analysis, reasoning and interpretation, which are crucial for gaining employment and developing academic competence.

## **Learning Outcomes**

By the end of this unit students will be able to:

- LO1. Examine Network Security principles, protocols and standards.
- LO2. Design a secure network for a corporate environment.
- LO3. Configure Network Security measures for the corporate environment.
- LO4 Undertake the testing of a network using a Test Plan.

## Essential Content

### L01 Examine Network Security principles, protocols and standards

*The history of Network Security.*

*Network Security devices:*

The historical Network Security (NS) principles and associated aspects such as Firewalls, Routers, Switches.

*Network Security protocols:*

MD5, SSL, VPN, AES, SHA-1/2, RSA, DES, 3DES, IPSec, DNS, DHCP, HTTP, HTTPs, FTP, FTPs, POP3, SMTP, IMAP.

*Network Security cryptographic types:*

Different types of public and private key cryptography such as Caesar Cipher, Vigenere, Hash.

### L02 Design a secure network for a corporate environment

*Build a network*

*Planning a network:*

Considerations must be thought through on what the network will be used for (purpose) according to the scenario.

*Hardware and software considerations:*

What hardware and software will be used on the network?

### L03 Configure Network Security measures for the corporate environment

*Configure Network Security:*

Configure Network Security measures such as Firewalls, Routers, Switches, Gateways, SSL, IPSec, HTTPs, FTPs, passwords and backup devices.

### L04 Undertake the testing of a network using a Test Plan

Create a Test Plan, test the Network Security and make some recommendations.

*Create a Test Plan:*

Testing data, expected results, actual results.

*Comprehensively Test all devices and the whole environment:*

Tests should be carried out on all devices (Firewall, Servers, Domain Controllers, Email Servers, Routers, Switches, gateways, passwords).

*Make recommendations:*

Make recommendations for improving the Network Security for your environment (scenario).

## Learning Outcomes and Assessment Criteria

Pass	Merit	Distinction
<b>LO1</b> Examine Network Security principles, protocols and standards		<b>LO1 &amp; LO2</b>  <b>D1</b> Discuss, using examples, the importance of Network Security.
<b>P1</b> Discuss the different types of Network Security devices.  <b>P2</b> Examine Network Security protocols.	<b>M1</b> Compare and contrast at least two major Network Security protocols.	
<b>LO2</b> Design a secure network for a corporate environment		
<b>P3</b> Investigate the purpose and requirements of a secure network according to a given scenario.  <b>P4</b> Determine which network hardware and software to use in this network.	<b>M2</b> Create a design of a secure network according to a given scenario.	
<b>LO3</b> Configure Network Security measures for the corporate environment		<b>D2</b> Discuss what is meant by Quality of Service (QoS) in relation to Network Security configuration.
<b>P5</b> Configure Network Security for your network.  <b>P6</b> Discuss different cryptographic types of Network Security.	<b>M3</b> Provide Network Security configuration scripts/files/screenshots with comments.	
<b>LO4</b> Undertake the testing of a network using a Test Plan		<b>D3</b> Critically evaluate the design, planning, configuration and testing of your network.
<b>P7</b> Create a Test Plan for your network.  <b>P8</b> Comprehensively test your network using the devised Test Plan.	<b>M4</b> Provide scripts/files/screenshots of the testing of your network.  <b>M5</b> Make some improvement recommendations.	



## Recommended Resources

### Textbooks

- Burgess, M. (2003) *Principles of Systems and Network Administration*. Chichester: John Wiley.
- Burns, B., Granick, J.S, Manzuik, S., Guersch P., Killion, D., Beauchesne, N., Moret, E., Dhanjani, N., Rios, B. and Hardin, B. (2009) *Hacking: The Next Generation*. O'Reilly.
- Cheswick, W. and Bellovin, S. (1994) *Firewalls and Internet Security: Repelling the Wily Hacker*. Wokingham: Addison-Wesley.
- Cole, E., Krutz, R.L., Conley, J.W., Reisman, B., Ruebush, M., Gollman, D. and Reese, R. (2008) *Network Security Fundamentals*. John Wiley & Sons, Inc.
- Cole, E., Krutz, R.L., Conley, J.W., Reisman, B., Ruebush, M., Gollman, D. and Reese, R. (2008) *Network Security Fundamentals: Project Manual*. John Wiley & Sons, Inc.
- Forouzan, B.A. (2008) *Cryptography and Network Security*. New York: McGraw-Hill.
- Forouzan, B.A. (2008) *Introduction to Network Security and Cryptography*. London: McGraw-Hill.
- Gollmann, D. (2006) *Computer Security*. Chichester: John Wiley.
- Harris, S., Harper, A., Eagle, C., Ness, J. and Lester, M. (2004) *Gray Hat Hacking: The Ethical Hacker's Handbook*. McGraw-Hill.
- Lammle, T. and Graves, K. (2007) *CEH: Official Certified Ethical Hacker Review Guide*. Sybex.
- Lockhart, A. (2007) *Network Security Hacks: Tips & Tools for Protecting your Privacy*, 2nd Ed. O'Reilly.
- Manzuik, S., Gold, A. and Gatford, C. (2007) *Network security Assessment: from vulnerability to patch*. Rockland, Ma: Syngress Publishing.
- Mather, T., Kumaraswamy, S. and Latif, S. (2009) *Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance*. O'Reilly.
- Oppliger, R. (1998) *Internet and Intranet Security*. London: McGraw-Hill.
- Scambray, J. and McClure, S. (2008) *Hacking Exposed Windows: Windows Security, Secrets and Solutions*. London: McGraw-Hill.
- Schneier, B. (2000) *Secrets and Lies: Digital Secrets in a Networked World*. Chichester: John Wiley.
- Sobrier, J., Lynn, M., Markham, E., Iezzoni, C. and Biondi, P. (2007) *Security Power Tools*, O'Reilly.
- Stallings, W. (2005) *Cryptography and Network Security*. Rockland, Ma: Syngress Publishing.

## **Journals**

*British Computer Society*

*ISC<sup>2</sup>*

*The Register*

## **Links**

This unit links to the following related units:

*Unit 2: Networking*

*Unit 5: Security*

*Unit 8: Computer Systems Architecture*

*Unit 15: Transport Network Design*

*Unit 35: Network Management*

*Unit 36: Client/Server Computing Systems*

# Unit 18: Discrete Maths

**Unit code** Y/615/1648

**Unit level** 5

**Credit value** 15

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## Introduction

Digital computer technologies operate with distinct steps, and data is stored within as separate bits. This method of finite operation is known as 'discrete', and the division of mathematics that describes computer science concepts such as software development, programming languages, and cryptography is known as 'discrete mathematics'. This branch of mathematics is a major part of computer science courses and ultimately aids in the development of logical thinking and reasoning that lies at the core of all digital technology.

This unit introduces students to the discrete mathematical principles and theory that underpin software engineering. Through a series of case studies, scenarios and tasked-based assessments students will explore set theory and functions within a variety of scenarios; perform analysis using graph theory; apply Boolean algebra to applicable scenarios; and finally explore additional concepts within abstract algebra.

Among the topics included in this unit are: set theory and functions, Eulerian and Hamiltonian graphs, binary problems, Boolean equations, Algebraic structures and group theory.

On successful completion of this unit students will be able to gain confidence with the relevant discrete mathematics needed to successfully understand software engineering concepts. As a result they will develop skills such as communication literacy, critical thinking, analysis, reasoning and interpretation, which are crucial for gaining employment and developing academic competence.

## Learning Outcomes

By the end of this unit students will be able to:

- LO1. Examine set theory and functions applicable to software engineering.
- LO2. Analyse mathematical structures of objects using graph theory.
- LO3. Investigate solutions to problem situations using the application of Boolean algebra.
- LO4. Explore applicable concepts within abstract algebra.

## Essential Content

### LO1 Examine set theory and functions applicable to software engineering

*Set theory:*

Sets and set operations.

Algebra within set theory.

Set identities and proof of identities.

Bags manipulation functions.

*Functions:*

*Domain, range and mappings.*

*Inverse relations and the inverse function.*

*Injective, surjective and transitive functions.*

### LO2 Analyse mathematical structures of objects using graph theory

*Graph theory:*

Structure and characterisation of graphs.

Spanning trees and rooted trees.

Eulerian and Hamiltonian graphs.

Vertex and edge colourings of graphs.

*Directed graphs:*

Directed and directed graphs.

Walks, trails, paths and shortest paths.

### LO3 Investigate solutions to problem situations using the application of Boolean algebra

*Boolean algebra:*

Binary states (e.g. on/off; 1/0; open/closed; high/low).

Identification of binary problems and labelling inputs and outputs.

Produce a truth table corresponding to a problem situation.

*Equations:*

Express a truth table as a Boolean equation.

Simplify a Boolean equation using algebraic methods.

Represent a Boolean equation using logic gates.

**L04 Explore applicable concepts within abstract algebra**

*Algebraic structures:*

Binary operations and associated properties.

Commutative and associative operations.

Algebraic structures and substructures.

*Groups:*

Introduction to groups, semigroups and monoids.

Families of groups and group codes.

Substructures and morphisms.

## Learning Outcomes and Assessment Criteria

Pass	Merit	Distinction
<b>LO1</b> Examine set theory and functions applicable to software engineering		<b>D1</b> Formulate corresponding proof principles to prove properties about defined sets.
<b>P1</b> Perform algebraic set operations in a formulated mathematical problem.  <b>P2</b> Determine the cardinality of a given bag (multiset).	<b>M1</b> Determine the inverse of a function using appropriate mathematical techniques.	
<b>LO2</b> Analyse mathematical structures of objects using graph theory		<b>D2</b> Construct a proof of the Five Colour Theorem.
<b>P3</b> Model contextualised problems using trees, both quantitatively and qualitatively.  <b>P4</b> Use Dijkstra's algorithm to find a shortest path spanning tree in a graph.	<b>M2</b> Assess whether an Eulerian and Hamiltonian circuit exists in an undirected graph.	
<b>LO3</b> Investigate solutions to problem situations using the application of Boolean algebra		<b>D3</b> Design a complex system using logic gates.
<b>P5</b> Diagram a binary problem in the application of Boolean Algebra.  <b>P6</b> Produce a truth table and its corresponding Boolean equation from an applicable scenario.	<b>M3</b> Simplify a Boolean equation using algebraic methods.	

Pass		Merit	Distinction
<b>LO4</b> Explore applicable concepts within abstract algebra			
<p><b>P7</b> Describe the distinguishing characteristics of different binary operations that are performed on the same set.</p> <p><b>P8</b> Determine the order of a group and the order of a subgroup in given examples.</p>	<p><b>M4</b> Validate whether a given set with a binary operation is indeed a group.</p>	<p><b>D4</b> Prepare a presentation that explains an application of group theory relevant to your course of study.</p>	

## Recommended Resources

### Textbooks

Attenborough, M. (2003) *Mathematics for Electrical Engineering and Computing*. Oxford: Newnes.

Piff, M. (2008) *Discrete Maths Software Engineers: An Introduction for Software Engineers*. Cambridge: Cambridge University Press.

### Journals

*Journal of Graph Theory*. Wiley

*Journal of Mathematical Modelling and Algorithms in Operations Research*. Springer

### Links

This unit links to the following related units:

*Unit 11: Maths for Computing*

*Unit 22: Applied Analytical Models*



# **Unit 19: Data Structures & Algorithms**

<b>Unit code</b>	<b>D/615/1649</b>
<b>Unit level</b>	<b>5</b>
<b>Credit value</b>	<b>15</b>

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## **Introduction**

The knowledge to implement algorithms and data structures that solve real problems, and knowing the purpose, complexity and use of algorithms is part of an essential toolkit for software engineers. An algorithm is a sequence of instructions used to manipulate data held in a structured form and together constitute design patterns for solving a diverse range of computer problems, including network analysis, cryptography, data compression and process control.

This unit introduces students to data structures and how they are used in algorithms, enabling them to design and implement data structures. The unit introduces the specification of abstract data types and explores their use in concrete data structures. Based on this knowledge, students should be able to develop solutions by specifying, designing and implementing data structures and algorithms in a variety of programming paradigms for an identified need.

Among the topics included in this unit are abstract data types specification, formal data notations, data encapsulation, complex data structures, programming language implementations using handles, pointers, classes and methods, algorithm types, data structure libraries, algorithm complexity, asymptotic testing and benchmarking.

On completion of this unit the student should be able to identify program data requirements, specify abstract data types using a formal notation, translate into concrete data structures and be able to develop, using a programming paradigm, different sorting, searching and navigational algorithms that implement complex data structures and evaluate their effectiveness.

As a result of studying this unit students will develop skills such as communication literacy, critical thinking, analysis, synthesis, reasoning and interpretation, which are crucial for gaining employment and developing academic competence.

## **Learning Outcomes**

By the end of the unit students will be able to:

- LO1. Examine abstract data types, concrete data structures and algorithms.
- LO2. Specify abstract data types and algorithms in a formal notation.
- LO3. Implement complex data structures and algorithms.
- LO4. Assess the effectiveness of data structures and algorithms.

## Essential Content

### L01 Examine abstract data types, concrete data structures and algorithms

#### *Abstract Data Types (ADTs):*

Specification of ADTs with formal notation.

#### *Data structures:*

Array; set; stack; queue; list; tree; types e.g. active, passive, recursive.

#### *Algorithm types:*

Recursive, backtracking, dynamic, divide & conquer, branch & bound, greedy, randomised, brute force.

#### *Algorithms:*

Sort; insertion, quick, merge, heap, bucket, selection; search linear, binary, binary search tree, recursive e.g. binary tree traversals; find path; travelling salesman.

### L02 Specify abstract data types and algorithms in a formal notation

#### *Design specification:*

Specify ADTs using formal notation e.g. ASN.1; use non-executable program specification language e.g. SDL, VDM; issues e.g. complexity in software development; design patterns, parallelism; interfaces; encapsulation, information hiding, efficiency.

#### *Creation:*

Pre-conditions, post-conditions, error-conditions.

### L03 Implement complex data structures and algorithms

#### *Implementation:*

Data structures; multidimensional arrays, linked lists, stacks, queues, trees, hash table, heap, graph Algorithms; sorting, searching, tree traversal, list traversal, hash functions, string manipulation, scheduling and recursive algorithms; using handle, pointer, class, methods; using an executable programming language.

#### **L04 Assess the effectiveness of data structures and algorithms**

*Use of data structure libraries (DSL):*

Limitations of DSL; manual selection of data structures; theoretical analysis; asymptotic analysis; size of N, Big O notation.

*Algorithm effectiveness:*

Run time benchmark, compiler/interpreter dependencies, resource usage, degree of parallelism, time, space, power performance, efficiency of garbage collection.

## Learning Outcomes and Assessment Criteria

Pass		Merit	Distinction
<b>LO1</b> Examine abstract data types, concrete data structures and algorithms			<b>D1</b> Analyse the operation, using illustrations, of two network shortest path algorithms, providing an example of each.
<b>P1</b> Create a design specification for data structures explaining the valid operations that can be carried out on the structures.	<b>P2</b> Determine the operations of a memory stack and how it is used to implement function calls in a computer.	<b>M1</b> Illustrate, with an example, a concrete data structure for a First In First out (FIFO) queue.  <b>M2</b> Compare the performance of two sorting algorithms.	
<b>LO2</b> Specify abstract data types and algorithms in a formal notation			<b>D2</b> Discuss the view that imperative ADTs are a basis for object orientation and, with justification, state whether you agree.
<b>P3</b> Using an imperative definition, specify the abstract data type for a software stack.	<b>M3</b> Examine the advantages of encapsulation and information hiding when using an ADT.		
<b>LO3</b> Implement complex data structures and algorithms			<b>D3</b> Critically evaluate the complexity of an implemented ADT/algorithm.
<b>P4</b> Implement a complex ADT and algorithm in an executable programming language to solve a well-defined problem.	<b>P5</b> Implement error handling and report test results.	<b>M4</b> Demonstrate how the implementation of an ADT/algorithm solves a well-defined problem.	

Pass	Merit	Distinction
<b>L04</b> Assess the effectiveness of data structures and algorithms		<b>D4</b> Evaluate three benefits of using implementation independent data structures.
<b>P6</b> Discuss how asymptotic analysis can be used to assess the effectiveness of an algorithm.  <b>P7</b> Determine two ways in which the efficiency of an algorithm can be measured, illustrating your answer with an example.	<b>M5</b> Interpret what a trade-off is when specifying an ADT using an example to support your answer.	

## Recommended Resources

### Textbooks

Cormen, T. (1990) *Introduction to Algorithms*. MIT Labs.

Cormen, T. (2002) *Instructors Manual: Introduction to Algorithms*. MIT Labs.

Heineman, G. (2009) *Algorithms in a Nutshell*. O'Reilly Publishing.

Larmouth, J. (1999) *ASN.1 Complete*. Kaufman Publishing.

Leiss, E. (2007) *A Programmer's Companion to Algorithm Analysis*. Chapman & Hall.

Sedgewick, R. (1983) *Algorithms*. Addison-Wesley.

Wirth, N. (2004) *Algorithms and Data Structures*. Oberon.

### Links

This unit links to the following related units:

*Unit 1: Programming*

*Unit 20: Advanced Programming*

*Unit 23: Cryptography*

# **Unit 20: Advanced Programming**

**Unit code** Y/615/1651

**Unit level** 5

**Credit value** 15

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## **Introduction**

Features of programming languages that are considered advanced are used to develop software that is efficient; it can affect the performance of an application as well as the readability and extensibility of the code, improving productivity and therefore reducing cost. Many commercial applications available today, whether for productivity or entertainment, will have used one or more design pattern in their development. A design pattern is a description of how to solve a problem that can be used in many different situations and can help deepen the understanding of object-orientated programming and help improve software design and reusability.

The aim of this unit is to familiarise students with these features and their best practices to ensure that their code is in line with industry standards.

Among the topics included in this unit are: object-orientated programming; polymorphism, encapsulation, class aggregation/association, constructors/destructors, inheritance, abstract classes, interfaces, containers, generics, introduction to design patterns and Unified Modelling Language (UML).

On successful completion of this unit students will be able to write code in an object-orientated fashion using design patterns where necessary and be able to model their code structure in UML class diagrams. As a result they will develop skills such as communication literacy, critical thinking, analysis, reasoning and interpretation, which are crucial for gaining employment and developing academic competence.

## **Learning Outcomes**

By the end of this unit students will be able to:

- LO1. Examine the key components related to the object-orientated programming paradigm, analysing design pattern types.
- LO2. Design a series of UML class diagrams.
- LO3. Implement code applying design patterns.
- LO4. Investigate scenarios with respect to design patterns.

## Essential Content

### L01 **Examine the key components related to the object-orientated programming paradigm, analysing design pattern types**

Outline the object-orientated paradigm characteristics:

Encapsulation, polymorphism, constructors/destructors, sub objects, abstract/concrete, interface, method redefinition, generics/templates, containers.

*Object-orientated class relationships:*

Generalisation/inheritance, realisation, dependency, aggregation, composition.

*Design patterns:*

Creational, structural and behavioural.

### L02 **Design a series of UML class diagrams**

*UML class design:*

Analyse a code scenario and utilise a suitable UML tool to develop class diagrams.

### L03 **Implement code applying design patterns**

*Implementation:*

Using an appropriate language & IDE to develop code that implements design patterns and utilises techniques to produce secure code.

### L04 **Investigate scenarios with respect to design patterns**

*Review the usage of design patterns:*

Relating design patterns to a range of given scenarios



## Learning Outcomes and Assessment Criteria

Pass		Merit	Distinction
<b>LO1</b> Examine the key components related to the object-orientated programming paradigm, analysing design pattern types			<b>D1</b> Analyse the relationship between the object-orientated paradigm and design patterns.
<b>P1</b> Examine the characteristics of the object-orientated paradigm as well as the various class relationships.	<b>M1</b> Determine a design pattern from each of the creational, structural and behavioural pattern types.		
<b>LO2</b> Design a series of UML class diagrams			<b>D2</b> Define/refine class diagrams derived from a given code scenario using a UML tool.
<b>P2</b> Design and build class diagrams using a UML tool.	<b>M2</b> Define class diagrams for specific design patterns using a UML tool.		
<b>LO3</b> Implement code applying design patterns			<b>D3</b> Evaluate the use of design patterns for the given purpose specified in M3.
<b>P3</b> Build an application derived from UML class diagrams.	<b>M3</b> Develop code that implements a design pattern for a given purpose.		
<b>LO4</b> Investigate scenarios with respect to design patterns			<b>D4</b> Critically evaluate a range of design patterns against the range of given scenarios with justification of your choices.
<b>P4</b> Discuss a range of design patterns with relevant examples of creational, structural and behavioural pattern types.	<b>M4</b> Reconcile the most appropriate design pattern from a range with a series of given scenarios.		

## Recommended Resources

### Textbooks

Freeman, E. et al. (2008) *Head First Design Patterns*. 4th Ed. United States of America: O'Reilly Media.

Gamma, E. et al. (1995) *Design Patterns: Elements of Reusable Object-Oriented Software*. 1st Ed. New Jersey: Addison-Wesley.

McLaughlin, B.D. et al. (2007). *Head First Object-Oriented Analysis and Design*. 1st Ed. United States of America: O'Reilly Media.

### Links

This unit links to the following related units:

*Unit 1: Programming*

*Unit 19: Data Structures & Algorithms*

*Unit 28: Prototyping*

*Unit 41: Analytic Architecture Design*

# Unit 21: Data Mining

**Unit code** H/615/1653

**Unit level** 5

**Credit value** 15

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## Introduction

Data mining is the process of discovering new knowledge in the forms of patterns and relationships in large data sets. It helps find knowledge from a data set that was previously impossible to obtain with traditional methods. Modern data mining is well equipped to discover useful knowledge or patterns from unstructured data such as web traffic, emails and social media content. Data mining uses a range of machine learning algorithms and modern statistical techniques to discover knowledge from data sets.

This unit will introduce the theoretical foundation of data mining and a range of data mining processes and techniques. The unit will also provide hands-on experience in developing data mining applications using an appropriate programming language or data mining tool.

Topics included in this unit are: data mining terminologies, scope of data mining such as classification, regression and clustering methods and techniques, associate pattern mining, mining time series data, and mining text data.

On successful completion of this unit, students will appreciate the theoretical and technical concepts of data mining and its techniques and processes, gain hands-on experience in implementing data mining techniques using a programming language such as Python, R, or a tool such as Weka, KNIME, Excel etc.

As a result students will develop skills such as communication literacy, critical thinking, analysis, reasoning and interpretation, which are crucial for gaining employment and developing academic competence.

It is assumed that students will have some knowledge of data analytics and machine learning, or will have completed Unit 12: Data Analytics and Unit 26: Machine Learning.

## Learning Outcomes

By the end of this unit students will be able to:

- LO1. Discuss the historical and theoretical foundation of data mining, its scope, techniques, and processes.
- LO2. Investigate a range of data mining techniques to discover patterns and relationships in large data sets.
- LO3. Illustrate how a data mining algorithm performs text mining to identify relationships within text.
- LO4. Evaluate a range of graph data mining techniques that recognise patterns and relationships in graph-based technologies.

## Essential Content

### **L01 Discuss the historical and theoretical foundation of data mining, its scope, techniques, and processes**

*Data mining terminologies.*

Historical background of data mining:

Traditional approach, modern approach.

*Theoretical background of data mining.*

*Ethics of data mining:*

Fundamentals of data mining, the major building blocks of data mining.

### **L02 Investigate a range of data mining techniques to discover patterns and relationships in large data sets**

*Scope of data mining:*

Classification, regression and clustering.

*Data mining algorithms:*

Classification algorithms, regression algorithms and clustering algorithms.

### **L03 Illustrate how a data mining algorithm performs text mining to identify relationships within text**

Introduction to text mining.

A brief overview to natural language processing.

Document preparation and similarities.

Clustering methods.

Topic Modelling.

Presentation methods of text (final outcome of the mining): charts, graphs, word cloud and so forth.

### **L04 Evaluate a range of graph data mining techniques that recognise patterns and relationships in graph-based technologies**

Unstructured data and graph-based technologies.

Networks and network analysis.

Graph algorithms: graph pattern mining, graph classification, graph clustering, and so forth.

Content mining, structure mining and usage mining.

Graph data mining tools.

## Learning Outcomes and Assessment Criteria

Pass	Merit	Distinction
<b>LO1</b> Discuss the historical and theoretical foundation of data mining, its scope, techniques, and processes		<b>D1</b> Discuss how an organisation benefits from data mining.
<b>P1</b> Investigate the historical background of data mining. <b>P2</b> Analyse the theoretical background of data mining and identify data mining tools used in industry.	<b>M1</b> Evaluate traditional and modern approaches to data mining and show the building blocks of both approaches.	
<b>LO2</b> Investigate a range of data mining techniques to discover patterns and relationships in large data sets		<b>D2</b> Develop a complete data mining application for a real world issue.
<b>P3</b> Demonstrate various scopes of data mining. <b>P4</b> Investigate a range of data mining algorithms and their uses.	<b>M2</b> Investigate a tool or programming language that can support data mining. <b>M3</b> Apply an appropriate tool or programming language to demonstrate how data mining algorithms work.	
<b>LO3</b> Illustrate how a data mining algorithm performs text mining to identify relationships within text		<b>D3</b> Develop a complete text mining application for a real world issue.
<b>P5</b> Discuss what is meant by text mining and explain with appropriate examples. <b>P6</b> Analyse how data mining algorithms, techniques, methods and approaches work.	<b>M4</b> Show how text mining works using a tool or programming language.	

Pass	Merit	Distinction
<b>LO4</b> Evaluate a range of graph data mining techniques that recognise patterns and relationships in graph based technologies		<b>D4</b> Develop a complete graph data mining application for a real world scenario.
<b>P7</b> Discuss what is meant by graph data mining and explain with appropriate examples.  <b>P8</b> Assess how graph mining algorithms work and identify appropriate programming languages and tools used by industry for graph data mining.	<b>M5</b> Demonstrate how graph data mining works using a tool or programming language.	

## Recommended Resources

### Textbooks

Aggarwal, C. (2015) *Data Mining: The Textbook*. Springer.

Hofmann, M. and Chisholm, A. (2015) *Text Mining and Visualization: Case Studies Using Open-Source Tools*. Chapman and Hall/CRC.

Russell, M. (2013) *Mining the Social Web: Data Mining Facebook, Twitter, LinkedIn, Google+, GitHub, and More*. 2nd Ed. O'Reilly Media.

Witten, I., Eibe, F. and Hall, M. (2011) *Data Mining: Practical Machine Learning Tools and Techniques*. 3rd Ed. Morgan Kaufmann.

### Websites

<a href="http://archive.ics.uci.edu/ml">archive.ics.uci.edu/ml</a>	University of California, Irvine "Machine Learning Repository" (Data sets)
<a href="http://www.lfd.uci.edu">www.lfd.uci.edu</a>	University of California, Irvine – Laboratory for Fluorescence Dynamics "Binaries for Python Extension Packages" (Development Tool)
<a href="http://cran.r-project.org">cran.r-project.org</a>	The R Project for Statistical Computing "R Archive Network" (Development Tool)
<a href="http://www.cs.waikato.ac.nz">www.cs.waikato.ac.nz</a>	University of Waikato – Machine Learning Group "Data Mining Software in Java" (Development Tool)
<a href="http://www.knime.org">www.knime.org</a>	Konstanz Information Miner "KNIME" (Development Tool)
<a href="http://gephi.org">gephi.org</a>	Open Graph Viz Platform "Gephi" (Development Tool)

### Links

This unit links to the following related units:

*Unit 12: Data Analytics*

*Unit 22: Applied Analytical Models*

*Unit 26: Machine Learning*

# **Unit 22: Applied Analytical Models**

**Unit code** K/615/1654

**Unit level** 5

**Credit value** 15

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## **Introduction**

Applied analytical modelling has become prevalent in many industries and has developed in the mathematical techniques used and the diversity of modelling tools and techniques. Applied analytical modelling is carried out by a data scientist utilising modelling data, model building and model reporting skills. The aim of this unit is to provide students with knowledge and analytical modelling skills using computers to discover and interpret meaningful patterns in data by creating computer models.

This unit introduces students to applied analytical models used in business to discover, interpret and communicate meaningful patterns of data held in silos or data warehouses, and to derive knowledge to gain competitive advantage. Organisations may apply analytical methods and models to predict/prescribe business outcomes and improve performance in diverse areas such as stock control, financial risk and fraud analysis. Analytical models use mathematical algorithms and require extensive computation to process large amounts of data.

Among the topics included in this unit are: data preparation, fundamentals of applied analytical models and development of predictive or prescriptive models using a suitable algorithm, operating on a large data set.

As a result they will develop skills such as communication literacy, critical thinking, analysis, reasoning and interpretation which are crucial for gaining employment and developing academic competence.

## **Learning Outcomes**

By the end of this unit students will be able to:

- LO1. Examine applied analytical modelling methods.
- LO2. Prepare a large data set for use in an applied analytical model.
- LO3. Demonstrate the use of an analytical model with a large data set.
- LO4. Investigate improvements to an applied analytical model.



## Essential Content

### L01 Examine applied analytical modelling methods

*Decision/descriptive analytics.*

*Prescriptive analytics:*

Confirmatory data analysis (CDA).

*Predictive analytics:*

Forecasting or classification algorithms, machine learning, scoring, correlation, causation, regression analysis.

Algorithms:

Filtering, sorting clustering; Data visualisation.

*Business Domains:*

Behavioural analytics; cohort analytics; collections analytics; cyber analytics; enterprise optimisation; financial analytics; fraud analytics; marketing analytics; pricing analytics; retail analytics; risk analytics; supply chain analytics; talent analytics; telecoms analytic; transportation analytics.

### L02 Prepare a large data set for use in an applied analytical model

*Identify and evaluate applied analytical model data requirements:*

Data requirements; data collection, data processing; semi-structured/unstructured metadata processing, cleaning; aggregation; exploratory data analysis (EDA); data product; data visualisation; information displays; dashboards.

### L03 Demonstrate the use of an analytical model with a large data set

*Define analytic model requirements:*

Data set selection; carry out cleaning, aggregation and EDA; identification of algorithm, selection and configuration of data mining software; model implementation; communication of results; data visualisation; graphical reports/dashboards.

### L04 Investigate improvements to an applied analytical model

Data quality; data assumptions; sampling; segmentation; uplift data modelling; algorithm selection; pattern and relationship discovery; qualitative/quantitative use; validating results; output communication methods; tailoring data visualisation.

## Learning Outcomes and Assessment Criteria

Pass		Merit	Distinction
<b>LO1</b> Examine applied analytical modelling methods			
<p><b>P1</b> Discuss the prescriptive and predictive analytical models, using examples.</p> <p><b>P2</b> Illustrate three analytical methods, describing how they function.</p>	<p><b>M1</b> Compare prescriptive and predictive analytical models, stating their advantages and disadvantages.</p>	<p><b>D1</b> Using a case study example, critically evaluate the derived benefits from the use of an applied analytic model.</p>	
<b>LO2</b> Prepare a large data set for use in an applied analytical model			
<p><b>P3</b> Describe the process of analytical model data preparation, describing data cleaning, discretisation, aggregation and data reduction stages.</p> <p><b>P4</b> Suggest two methods to visualise the output from an applied analytical model, using illustrations to describe your answer.</p>	<p><b>M2</b> Evaluate three potential issues in preparation of data for use in an applied analytical model.</p>	<p><b>D2</b> Discuss the primary reasons for carrying out data transformation before input to an applied analytical model.</p>	
<b>LO3</b> Demonstrate the use of an analytical model with a large data set			
<p><b>P5</b> Select a suitable algorithm to analyse a large data set to meet a business need.</p> <p><b>P6</b> Use an appropriate analytical modelling tool to carry out an investigation (e.g. R, RapidMiner, Hadoop).</p>	<p><b>M3</b> Propose how the data set will be prepared for the analytical model used in the investigation.</p>	<p><b>D3</b> Discuss the results of the investigation, assessing the quality of the obtained knowledge.</p>	

Pass	Merit	Distinction
<b>L04</b> Investigate improvements to an applied analytical model		<b>D4</b> Present the results of your investigation promoting the benefits of using applied analytical models in a business.
<b>P7</b> Discuss how the investigation requirements have been fulfilled.	<b>M4</b> Propose three improvements to the approach used in the investigation.  <b>M5</b> Discuss two ways to increase the performance and limits of the analytical model used in the investigation.	

## Recommended Resources

### Textbooks

Carlberg, C. (2012) *Predictive Analytics: Microsoft Excel*. QUE.

Marr, B. (2015) *Big Data: Using SMART Big Data, Analytics and Metrics To Make Better Decisions and Improve Performance*. Wiley.

Runkler, T. (2012) *Data Analytics: Models and Algorithms for Intelligent Data Analysis*. Springer Vieweg.

### Websites

<a href="http://www.ericsson.com">www.ericsson.com</a>	Ericsson White paper "Big Data Analytics – Actionable Insights for the Communication Service Provider" (Research)
<a href="http://www.thearling.com">www.thearling.com</a>	Kurt Thearling "Information about analytics and data science" (General Reference)
<a href="http://aisel.aisnet.org">aisel.aisnet.org</a>	Association of Information Systems "Big Data Analytics: Concepts, Technologies, and Applications" (Tutorial)
<a href="http://www.fujitsu.com">www.fujitsu.com</a>	Fujitsu "The White Book of Big Data" (E-Book)

### Links

This unit links to the following related units:

*Unit 11: Maths for Computing*

*Unit 12: Data Analytics*

*Unit 14: Business Intelligence*

*Unit 18: Discrete Maths*

# Unit 23: Cryptography

**Unit code** T/615/1656

**Unit level** 5

**Credit value** 15

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## Introduction

Although confidentiality in the communication between two parties is very often linked with electronic data transfer, methods for ensuring confidentiality have been used for centuries. That is how cryptography started as a methodology, practice and discipline, ensuring confidential communication in the presence of third parties called 'adversaries'. However, encrypting the message for confidentiality purposes is only one aspect of cryptography. It also provides means of ensuring that the parties involved in communication are 'who they say they are'. Cryptography underpins many aspects of security, and is a crucial component in protecting the confidentiality and integrity of information. It is now a prevalent part of our day-to-day lives despite many people being unaware of its usage or importance. Almost every interaction we make with an electronic device will involve cryptography in some form. Cryptography is an indispensable tool for protecting information in computer systems.

This unit introduces students to the theoretical principles of cryptography and looks at some practical applications, many of which we use on a daily basis. Students are expected to investigate the inner workings of cryptographic systems and how to correctly use them in real-world applications. Students are expected to explore the mathematical algorithms in relation to cryptography and their applications. Students are also expected to analyse the symmetric and asymmetric encryption methods and ciphers, public key cryptography and the security issues related to their implementation. In addition, students are expected to investigate advanced encryption protocols and their applications.

Among the topics included in this unit are: the mathematical algorithms used in cryptography, the mechanisms by which symmetric and asymmetric cryptography work, 3DES and AES block ciphers, the operations of public key cryptography, Public Key Infrastructure (PKI), primality testing and factoring, discrete logarithms, El Gamal encryption, security issues with cryptography, common attacks on cryptographic schemes, and some practical applications of cryptography.

On successful completion of this unit students will be able to examine the symmetric encryption algorithms and ciphers, assess public key encryption protocols and signatures and their uses in the message and key exchanges, analyse the security issues related to symmetric and asymmetric encryption methods and evaluate advanced encryption protocols and their applications in secure message exchanges.

As a result they will develop skills such as critical thinking, analysis, and interpretation, which are crucial for gaining employment and developing academic competence.

## Learning Outcomes

By the end of this unit students will be able to:

- LO1. Examine the symmetric encryption algorithms and ciphers.
- LO2. Assess public key encryption protocols and signatures and their uses in the message and key exchanges.
- LO3. Analyse the security issues related to symmetric and asymmetric encryption methods.
- LO4. Evaluate advanced encryption protocols and their applications in secure message exchanges.

## Essential Content

### L01 Examine the symmetric encryption algorithms and ciphers

*Exploring mathematical algorithms:*

Examining modular arithmetic, groups, finite fields and probability; random number generation, exploring elliptic curves and projective coordinates.

Examining symmetric encryption and ciphers:

Exploring historical ciphers, Cezar cipher, Enigma machine and information theoretic security (probability and ciphers, entropy and spurious keys); explaining one time pad.

Investigating stream ciphers, the historical Lorenz cipher, modern stream ciphers (linear feedback shift registers and their combinations, RC4).

Examining block ciphers, Feistel cipher and Data Encryption Standard (DES), operation of 3DES, Rijndael cipher and its mode of operation, explaining Advanced Encryption System (AES).

Analysing symmetric key distributions, hash functions and message authentication codes – key management, secret key distribution, designing hash functions, investigating message authentication codes.

### L02 Assess public key encryption protocols and signatures and their uses in the message and key exchanges

*Analysing public key cryptography:*

Examining public key encryption algorithms, one-way functions, Rivest Shamir Adleman (RSA) algorithm; explaining El Gamal encryption.

Explaining primality testing and factoring and discrete logarithms, prime numbers, factoring algorithms, modern factoring methods; examining Pohlig-Hellman logarithm, logarithmic methods for finite fields, methods for elliptic curves.

Examining key exchange and signature schemes, Diffie-Hellman key exchange, explore digital signatures, using hash functions in signature schemes, digital signature algorithm (DSA), and authenticated key agreement.

Analysing implementation issues and, exponentiation in RSA and DSA, finite field arithmetic.

Obtaining authentic public keys, confidentiality and integrity, digital certificates and Public Key Infrastructure (PKI), analysing examples of PKI.

**L03 Analyse the security issues related to symmetric and asymmetric encryption methods**

*Analysing attacks on public key schemes:*

Exploring most common attacks on public key encryption schemes, Wiener's attack on RSA, Lattice-based attacks on RSA, partial key exposure attacks, Meet-in-the-Middle attack, brute force attack and fault analysis.

*Analysing different definitions of security:*

Examining security of encryption, security of actual encryption algorithms, semantically secure systems, security of signatures.

Analysing provable security, explaining random oracles, security of encryption algorithms and encryption algorithms with random oracles.

Explaining provable security without random oracles, using examples such as strong RSA assumption, signature schemes and encryption schemes.

Analysing hybrid encryption, security of symmetric ciphers, security of hybrid ciphers, explaining the construction of Key Encapsulation Mechanisms (KEMs)

**L04 Evaluate advanced encryption protocols and their applications in secure message exchanges**

*Assessing advanced encryption protocols and their applications:*

Evaluating access structures for secret sharing schemes, general secret sharing, Reed-Solomon codes, Shamir sharing scheme.

Applying shared RSA signature generation; explaining commitment schemes and oblivious transfers.

Analysing Zero-Knowledge proofs, demonstrating a Graph Isomorphism in Zero-Knowledge, Sigma protocols, electronic voting systems.

Examining secure multi-party computation, the two-party case, multi-party cases: honest-but-curious adversaries, malicious adversaries.

Evaluating different applications of cryptography, quantum cryptography, digital cash, Bitcoin, Transport Layer Security and IPSec.



## Learning Outcomes and Assessment Criteria

Pass		Merit	Distinction
<b>LO1</b> Examine the symmetric encryption algorithms and ciphers			<b>LO1 &amp; LO2</b>  <b>D1</b> Evaluate the improvement introduced by AES compared to DES and 3DES encryption standards.
<b>P1</b> Examine mathematic algorithms and their use in cryptography.  <b>P2</b> Explain, with the use of examples, the operation of stream cipher and block cipher.	<b>M1</b> Compare the operational differences between stream cipher and block cipher.  <b>M2</b> Analyse issues with symmetric key distribution and how they are solved by hash functions and message authentication codes.		
<b>LO2</b> Assess public key encryption protocols and signatures and their uses in the message and key exchanges			
<b>P3</b> Discuss common public key cryptographic methods and their uses.  <b>P4</b> Explain by the use of examples public key exchange and digital signatures, and their implementation issues.	<b>M3</b> Analyse, with examples, the Public Key Infrastructure (PKI).		
<b>LO3</b> Analyse the security issues related to symmetric and asymmetric encryption methods			<b>D2</b> Evaluate different definitions of provable security.
<b>P5</b> Discuss the common attacks on public key encryption schemes.  <b>P6</b> Explain, with examples, provable security in signature schemes and encryption schemes.	<b>M4</b> Critically analyse the security of hybrid ciphers and the construction of Key Encapsulation Mechanisms (KEMs).		

Pass	Merit	Distinction
<b>L04</b> Evaluate advanced encryption protocols and their applications in secure message exchanges		<b>D3</b> Critically evaluate the access structures for secret sharing schemes.
<b>P7</b> Examine, by the use of examples, secret sharing schemes.  <b>P8</b> Evaluate secure multi-party computation using the two-party and multi-party cases.	<b>M5</b> Analyse the implementation of public key cryptography in electronic voting systems.	

## Recommended Resources

### Textbooks

Martin, K. (2012) *Everyday Cryptography: Fundamental Principles and Applications*. UK: Oxford.

Stallings, W. (2013) *Cryptography and Network Security: Principles and Practice*. UK: Pearson.

### Journals

*International Association for Cryptologic Research, Online*

*International Journal of Applied Cryptography, Online*

### Websites

[www.gov.uk/government/publications](http://www.gov.uk/government/publications)

Department of Business Innovations and Skills

"Guidelines for managing projects – How to organise, plan and control projects." (Report)

### Links

This unit links to the following related units:

*Unit 5: Security*

*Unit 19: Data Structures & Algorithms*

*Unit 24: Forensics*

*Unit 25: Information Security Management*

# Unit 24: Forensics

**Unit code** F/615/1658

**Unit level** 5

**Credit value** 15

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## Introduction

This unit introduces students to digital forensics involving the use of specialised techniques to investigate the recovery, authentication and analysis of data on electronic data storage devices as well as Network Security breaches and cyberattacks using different tools and techniques.

With the current widespread use of digital devices, digital forensics has become an important part of the detection of crime by being able to identify details of what has been stored on a digital device(s) in the past. Students will have the opportunity to learn about some of the lower level structures of data storage devices, and techniques used to investigate them.

Among the topics included in this unit are: describing the process of carrying out digital forensics; Forensic Investigation legal guidelines and procedures; understanding low level file structures of several Operating Systems (OS); creating a boot disk to enable forensic examination of devices; and undertaking a forensic examination of a device(s) and/or Network Security breaches and cyberattacks.

On successful completion of this unit students will be able to carry out digital forensics in accordance with industry and legal guidelines and procedures using different tools as well as understand low-level file structures of several Operating Systems and undertake digital Forensic Investigation of devices.

As a result they will develop skills such as communication literacy, critical thinking, analysis, reasoning and interpretation, which are crucial for gaining employment and developing academic competence.

## Learning Outcomes

By the end of this unit students will be able to:

- LO1. Examine the processes and procedures for carrying out digital Forensic Investigation.
- LO2. Discuss the legal and professional guidelines and procedures for carrying out digital Forensic Investigation.
- LO3. Use a tool or tools to conduct digital Forensic Investigation on devices or networks or cyberattacks.
- LO4. Develop a Test Plan and make some recommendations for use in digital Forensic Investigation.

## Essential Content

### **L01 Examine the processes and procedures for carrying out digital Forensic Investigation**

*The process of carrying out digital Forensic Investigation:*

Discuss what is meant by Digital Forensics.

Identify the processes and procedures for carrying out digital Forensic Investigation.

### **L02 Discuss the legal and professional guidelines and procedures for carrying out digital Forensic Investigation**

*Processes and procedures for carrying out digital Forensic Investigation:*

*Law enforcement:*

Give a summary of the APCO guidelines in relation to evidence collection, evidence preservation in a Forensic Investigation case. Discuss the activities of authorities (e.g. MI5/MI6, GCHQ and NSA) in relation to Forensic Investigations.

*Legal and ethical considerations:*

Discuss the following legal and ethical considerations when conducting a Forensic Investigation; Data Protection Act; Computer Misuse Act and the Freedom of Information Act.

*Other stakeholders:*

Forensic Science's Society guidelines

British Computer Society

### **L03 Use a tool or tools to conduct digital Forensic Investigation on devices or networks or cyberattacks**

*Tools required to conduct digital Forensic Investigation:*

Hardware and software tools.

*Conduct digital Forensic Investigation:*

Conduct digital Forensic Investigation of devices, networks or cyberattacks.

**L04 Develop a Test Plan and make some recommendations for use in digital Forensic Investigation**

*Develop a Test Plan for digital devices or networks or cyberattacks:*

Digital Forensics Test Plan

Recommendations for improving digital Forensic Investigations.

## Learning Outcomes and Assessment Criteria

Pass		Merit	Distinction
<b>LO1</b> Examine the processes and procedures for carrying out digital Forensic Investigation			<b>D1</b> Investigate the advantages and disadvantages of conducting digital Forensic Investigation.
<b>P1</b> Discuss what is meant by Digital Forensics with the aid of diagrams/pictures.	<b>P2</b> Examine the processes and procedures for conducting digital Forensic investigation.	<b>M1</b> Discuss the importance of following a process or procedure when conducting digital Forensic Investigation.	
<b>LO2</b> Discuss the legal and professional guidelines and procedures for carrying out digital Forensic Investigation			<b>D2</b> Discuss why NOT following guidelines might jeopardise a legal case with regards to digital Forensic evidence.
<b>P3</b> Examine several law enforcement guidelines for conducting digital Forensic Investigations.	<b>P4</b> Discuss several legal and ethical requirements for conducting digital Forensic Investigations.	<b>M2</b> Assess how ethical it is to conduct digital Forensic Investigations on a suspected individual with reference to their legal rights.	
<b>LO3</b> Use a tool or tools to conduct digital Forensic Investigation on devices or networks or cyberattacks			<b>LO3 &amp; 4</b> <b>D3</b> Critically evaluate your work and suggest improvements to the current digital Forensic Investigation guidelines, processes and procedures.
<b>P5</b> Determine hardware and software tools that can be used to conduct digital Forensic Investigation.	<b>P6</b> Examine the file system structure of several Operating Systems e.g. MS-DOS, Windows, UNIX, Linux, MacOS, Android, etc.	<b>M3</b> Compare two tools that can be used to conduct digital Forensic Investigation. <b>M4</b> Conduct a digital Forensic Investigation on a device or network or cyberattack.	

Pass	Merit	Distinction
<b>LO4</b> Develop a Test Plan and make some recommendations for use in digital Forensic Investigation		
<b>P7</b> Develop a Test Plan for conducting a test on digital devices or networks or cyberattacks.	<b>M5</b> Make recommendations for best practices for conducting digital Forensics.	



## Recommended Resources

### Textbooks

- Carrier, B. (2005) *File System Forensic Analysis*. Harlow: Addison-Wesley.
- Carvey, H. (2004) *Windows Forensics and Incident Recovery*. Harlow: Addison-Wesley.
- Farmer, D. and Venema, W. (2005) *Forensic Discovery*. Harlow: Addison-Wesley.
- Jones, R. (2005) *Internet Forensics*. Sebastopol, O'Reilly.
- Proise, C. and Mandia, K. (2003) *Incident Response: Computer Forensics*. Osborne/McGraw-Hill.
- Sammes, A. and Jenkinson, B. (2007) *Forensic Computing: A Practitioner's Guide*. 2nd Ed. London, Springer.

### Journals

*British Computer Society Forensics Specialist Group*  
*GCHQ*  
*NSA*

### Links

This unit links to the following related units:

*Unit 5: Security*  
*Unit 23: Cryptography*  
*Unit 25: Information Security Management*

# **Unit 25: Information Security Management**

**Unit code** F/615/1661

**Unit level** 5

**Credit value** 15

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## **Introduction**

Organisations of all sizes need to protect their sensitive information from potential attackers, and simply having up-to-date firewalls, anti-virus, and other infrastructure components is not enough to prevent breaches. All physical security devices, the teams who manage them, and the processes surrounding their management need to be constantly monitored and evaluated to ensure the organisation as a whole is protected. This is the concept behind an Information Security Management System (ISMS). An ongoing process to continually assess what the organisation deems its biggest threats, and what its most important assets are.

This unit introduces students to the basic principles of an ISMS and how businesses use them to effectively manage the ongoing protection of sensitive information they hold. There are many reasons for establishing an ISMS for an organisation, but one of the main goals is to enable the organisation to manage information security as a single entity which can be monitored and continually improved upon.

This unit considers information security management in a business context and will allow students to understand how modern organisations manage the ongoing threats to their sensitive assets.

On successful completion of this unit students will be able to describe what an ISMS is, how one is established, maintained and improved, and describe the role international standards play in developing an ISMS. As a result students will develop skills such as communication literacy, critical thinking, analysis, reasoning and interpretation, which are crucial for gaining employment and developing academic competence.

## **Learning Outcomes**

By the end of this unit students will be able to:

- LO1. Explore the basic principles of information security management.
- LO2. Critically assess how an organisation can implement and maintain an Information Security Management System (ISMS).
- LO3. Appraise an ISMS and describe any weaknesses it may contain.
- LO4. Examine the strengths and weaknesses of implementing ISMS standards.

## Essential Content

### **L01 Explore the basic principles of information security management**

What is an ISMS? Why is an ISMS important? Policies (privacy, acceptable use, information security, separation of duties, least privilege); risk (impact, likelihood, quantitative, qualitative, vulnerabilities, threats); risk treatment (avoid, transfer, accept, mitigate); compliance; stakeholders.

### **L02 Critically assess how an organisation can implement and maintain an Information Security Management System (ISMS)**

Asset identification; stakeholder requirements; risk assessment; risk treatment planning; policy development; procedure development; senior management buy-in; audit (internal, external); performance monitoring; continual improvement.

### **L03 Appraise an ISMS and describe any weaknesses it may contain**

Review ISMS documentation for potential weaknesses; examine audit and performance monitoring output; suggest improvements to an ISMS.

### **L04 Examine the strengths and weaknesses of implementing ISMS standards**

ISO 27001:2013; the organisation and its context; expectations of interested parties; determining ISMS scope; leadership commitment; policy; organisational roles and responsibilities; actions to address risks; information security objectives; resources; competence; awareness; communications; documented information; operational planning; risk assessment; risk treatment; monitoring, measuring, analysis and evaluation; management review; nonconformity and corrective action; continual improvement; external ISMS audit; advantages and disadvantages of ISO 27001:2013 certification; annex A (ISO 27002:2013) controls.

## Learning Outcomes and Assessment Criteria

Pass		Merit	Distinction
<b>LO1</b> Explore the basic principles of information security management			<b>LO1 &amp; LO2</b> <b>D1</b> Demonstrate through critical analysis the steps required to establish and maintain an ISMS in the context of an example organisation, making reference to the requirements of the ISO 27001:2013 standard.
<b>P1</b> Examine the key principles of an ISMS and its relevance to the successful operation of an organisation.		<b>M1</b> Evaluate the benefits an effective ISMS can have on an organisation.	
<b>LO2</b> Critically assess how an organisation can implement and maintain an Information Security Management System (ISMS)			
<b>P2</b> Explore the elements of, and processes behind, establishing and maintaining an ISMS.		<b>M2</b> Examine the process of implementing an ISMS in a real-world scenario.	<b>LO3 &amp; LO4</b> <b>D2</b> Critically examine the strengths and weaknesses in the context of an example ISMS and provide potential remedial actions to improve its effectiveness.
<b>LO3</b> Appraise an ISMS and describe any weaknesses it may contain			
<b>P3</b> Recognise strengths and weaknesses in a given ISMS, based on documentation review and audit output.		<b>M3</b> Examine the strengths and weaknesses of an ISMS in the context of an organisation, prioritising issues.	
<b>LO4</b> Examine the strengths and weaknesses of implementing ISMS standards			
<b>P4</b> Recognise the purpose of the ISO 27000 series and the key clauses of ISO 27001:2013.		<b>M4</b> Evaluate the relationship between ISO 27001:2013 and establishing an effective ISMS within an organisation. <b>M5</b> Critically assess the advantages and disadvantages of certification against the standard.	

## Recommended Resources

### Textbooks

Alexander, D., Finch, A., Sutton, D. and Taylor, A. (2013) *Information Security Management Principles* BCS. 2nd Revised Ed. The Chartered Institute for IT.

Calder, A. and Watkins, S. (2015) *IT Governance: An International Guide to Data Security and ISO27001/ISO27002*. 6th Ed. Kogan Page.

### Journals

*Information Management & Computer Security*

### Websites

[www.iso.org](http://www.iso.org)

International Organisation for Standardisation  
"ISO/IEC 27001 – Information Security  
Management" (General Reference)

### Links

This unit links to the following related units:

*Unit 5: Security*

*Unit 23: Cryptography*

*Unit 24: Forensics*

# Unit 26: Machine Learning

**Unit code** J/615/1662

**Unit level** 5

**Credit value** 15

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## Introduction

Machine learning is the science of getting computers with the ability to learn from data or experience to solve a given problem without being explicitly programmed. It has been around for many years, however it has become one of the hottest fields of study in the computing sector. Machine learning is in use in several areas such as predictive modelling, speech recognition, object recognition, computer vision, anomaly detection, medical diagnosis and prognosis, robot control, time series forecasting and much more.

This unit will introduce the basic theory of machine learning, the most efficient machine learning algorithms and practical implementation of these algorithms. Students will gain hands-on experience in getting these algorithms to solve real-world problems.

Topics included in this unit are: the foundations of machine learning, types of learning problems (classification, regression, clustering etc.), taxonomy of machine learning algorithms (supervised learning, unsupervised learning, reinforcement learning), machine learning algorithms (Decision Tree, Naïve Bayes, k-Nearest Neighbour, Support Vector Machine etc.).

On successful completion of this unit students will be able to understand the concept of machine learning, machine learning algorithms, gain hands-on experience in implementing algorithms using a programming language such as C/C++, C#, Java, Python, R, or a machine learning tool such as Weka, KNIME, MS AzureML etc.

As a result students will develop skills such as communication literacy, critical thinking, analysis, reasoning and interpretation, which are crucial for gaining employment and developing academic competence.

## Learning Outcomes

By the end of this unit students will be able to:

- LO1. Analyse the theoretical foundation of machine learning to determine how an intelligent machine works.
- LO2. Investigate the most popular and efficient machine learning algorithms used in industry.
- LO3. Develop a machine learning application using an appropriate programming language or machine learning tool for solving a real-world problem.
- LO4. Evaluate the outcome or the result of the application to determine the effectiveness of the learning algorithm used in the application.

## Essential Content

### L01 **Analyse the theoretical foundation of machine learning to determine how an intelligent machine works**

Consideration of what learning is.

Definitions of machine learning.

Core terminologies of machine learning.

*Types of learning problems: classification, regression, optimisation, clustering.*

How does machine learning work? Supervised learning, unsupervised learning, reinforcement learning, semi-supervised learning, deep learning.

### L02 **Investigate the most popular and efficient machine learning algorithms used in industry**

*Machine learning algorithms and appropriate programming languages or tools:*

Introduction to programming languages or tools.

Introduction to the language or tool.

A quick tour of the language or tool.

*Investigating the mathematical background of machine learning with the programming language or tool:*

Formulas, functions, descriptive statistics and graphs, probability.

*Investigate the machine learning algorithm and demonstrate using the programming language or a tool:*

K-Nearest Neighbour, Support Vector Machine, Linear Regression, Decision Tree, Naïve Bayes, K-Means Clustering.

### L03 **Develop a machine learning application using an appropriate programming language or machine learning tool for solving a real-world problem**

*Problem definition:*

Investigate and characterise the problem in order to better understand the goals of the project.

*Data analysis:*

Understand the available data (rows, columns, classes data range and so forth).

*Data preparation:*

Separate the data as training sets and testing set in order to expose better the structure of the prediction to modelling algorithms.

*Implement the algorithm:*

Implement the algorithm with an appropriate programming language or tool, train the model using training data set, present results.

**L04 Evaluate the outcome or the result of the application to determine the effectiveness of the learning algorithm used in the application**

Improving models' accuracy.

Under-fitting situations.

Over-fitting situations.



## Learning Outcomes and Assessment Criteria

Pass		Merit	Distinction
<b>LO1</b> Analyse the theoretical foundation of machine learning to determine how an intelligent machine works			<b>LO1 &amp; LO2</b> <b>D1</b> Critically evaluate why machine learning is essential to the design of intelligent machines.
<b>P1</b> Analyse the types of learning problems. <b>P2</b> Demonstrate the taxonomy of machine learning algorithms.	<b>M1</b> Evaluate the category of machine learning algorithms with appropriate examples.		
<b>LO2</b> Investigate the most popular and efficient machine learning algorithms used in industry			
<b>P3</b> Investigate a range of machine learning algorithms and how these algorithms solve the learning problems. <b>P4</b> Demonstrate the efficiency of these algorithms by implementing them using an appropriate programming language or machine learning tool.	<b>M2</b> Critically evaluate these algorithms with an appropriate case study in order to determine the power of these algorithms.		
<b>LO3</b> Develop a machine learning application using an appropriate programming language or machine learning tool for solving a real-world problem			<b>LO3 &amp; LO4</b> <b>D2</b> Develop an outstanding machine learning application for a real client to overcome their organisations concerns.
<b>P5</b> Chose an appropriate learning problem and prepare the training and test data sets in order to implement a machine learning solution. <b>P6</b> Implement a machine learning solution with a suitable machine learning algorithm and demonstrate the outcome.	<b>M3</b> Test the machine learning application using a range of test data and explain each stages of this activity.		

Pass	Merit	Distinction
<b>LO4</b> Evaluate the outcome or the result of the application to determine the effectiveness of the learning algorithm used in the application		
<b>P7</b> Discuss whether the result is balanced, under-fitting or over-fitting.	<b>M4</b> Evaluate the effectiveness of the learning algorithm used in the application.	

## Recommended Resources

### Textbooks

Bell, J. (2014) *Machine Learning: Hands-On for Developers and Technical Professionals*. 1st Ed. Wiley.

Flach, P. (2012) *Machine Learning: The Art and Science of Algorithms that Make Sense of Data*. 1st Ed. Cambridge: Cambridge University Press.

Kirk, M. (2014) *Thoughtful Machine Learning: A Test-Driven Approach*. O'Reilly Media.

### Websites

<a href="http://archive.ics.uci.edu/ml">archive.ics.uci.edu/ml</a>	University of California, Irvine "Machine Learning Repository" (Data sets)
<a href="http://www.lfd.uci.edu">www.lfd.uci.edu</a>	University of California, Irvine – Laboratory for Fluorescence Dynamics "Binaries for Python Extension Packages" (Development Tool)
<a href="http://cran.r-project.org">cran.r-project.org</a>	The R Project for Statistical Computing "R Archive Network" (Development Tool)
<a href="http://www.cs.waikato.ac.nz">www.cs.waikato.ac.nz</a>	University of Waikato – Machine Learning Group "Data Mining Software in Java" (Development Tool)
<a href="http://www.knime.org">www.knime.org</a>	Konstanz Information Miner "KNIME" (Development Tool)
<a href="http://www.codechef.com">www.codechef.com</a>	CodeChef educational initiative "List of Compilers" (Wiki)
<a href="http://julia-lang.org">julia-lang.org</a>	Julia Programming Language (Development Tool)
<a href="http://pkg.julia-lang.org">pkg.julia-lang.org</a>	Julia Programming Language (Development Tool)
<a href="http://azure.microsoft.com">azure.microsoft.com</a>	Microsoft Azure (Development Tool)
<a href="http://accord-framework.net">accord-framework.net</a>	Accord.NET Framework (Development Tool)

### Links

This unit links to the following related units:

*Unit 21: Data Mining*

*Unit 27: Artificial Intelligence*

# Unit 27: Artificial Intelligence

**Unit code** L/615/1663

**Unit level** 5

**Credit value** 15

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## Introduction

One of the dreams of the computing sector is to build an intelligent digital assistant that could serve people according to peoples' nature. Building this type of intelligent machine is a big challenge to computer scientists. An intelligent machine must have at least the following behaviours – vision, speech and voice recognition, smelling sense, learning from experience to solve new problems and coping with the unknown. The science of artificial intelligence (AI) is trying to overcome these challenges by combining the study of nature, understanding from humans' intelligent behaviour and brain function, other animal's acute senses, with mathematics, statistics, logic and traditional computer science. Some of AI's achievements include the NASA's Mars Rover, Google's Self-Driving Cars, IBM's Watson, Microsoft's Xbox 360 (the first gaming device to track human body movement) and much more.

This unit is designed to introduce the philosophy behind artificial intelligence, the most efficient techniques of AI and various intelligent systems that help us to overcome various challenges. This unit guides the student to investigate the emerging AI technologies which could solve various real-world challenges and problems.

Topics included in this unit are the philosophical background to AI, current trends and the future of AI, ethics and issues in AI, a range of AI applications (computer vision, speech processing and so forth), top-down approach of AI techniques, fuzzy logic, knowledge-based systems, natural language processing), bottom-up approach of AI techniques (neural networks, evolutionary computing, swarm intelligence), and emerging AI technologies (Brain Computer Interfacing, Ambient AI, Smart City, GPU AI etc).

On successful completion of this unit students will be able to understand the fundamental concepts in artificial intelligence from a theoretical, practical and cognitive point of view, and also gain innovative thought processes to build intelligent systems for future needs. Furthermore, the students can gain hands-on experience in developing intelligent systems using a programming language such as C/C++, C#, Java, Prolog, Lisp, Python, R, or a tool such as Weka, KNIME, MS AzureML, Accord.NET, AForge.NET, Neuroph, tools for NLP (NLTK, AIML), tools for swarm robotics (Microsoft robotics developer studio, Orocos, 'Player Stage Gazebo') etc.

As a result students will develop skills such as communication literacy, critical thinking, analysis, reasoning and interpretation, which are crucial for gaining employment and developing academic competence.

## Learning Outcomes

By the end of this unit students will be able to:

- LO1. Analyse the theoretical foundation of artificial intelligence, current trends and issues to determine the effectiveness of AI technology.
- LO2. Implement an intelligent system using a technique of the top-down approach of AI.
- LO3. Implement an intelligent system using a technique of the bottom-up approach of AI.
- LO4. Investigate and discuss a range of emerging AI technologies to determine future changes in industry.

## Essential Content

### **L01 Analyse the theoretical foundation of artificial intelligence, current trends and issues to determine the effectiveness of AI technology**

#### *Philosophical background of AI:*

What is an intelligence? How does the brain work? What is artificial intelligence? The Turing test, John Searle's 'The Chinese Room' test, Strong AI vs. Weak AI, Top-down approach of AI vs. bottom up approach of AI.

#### *Top-down approach of AI:*

Knowledge-based system, natural language processing, fuzzy logic.

#### *Bottom up approach of AI:*

Artificial neural networks, evolutionary computing, swarm intelligence.

#### *Applications of AI:*

Intelligent Robot, intelligent agent, artificial life, computer vision, speech recognition, artificial nose, data mining and other smart technologies.

#### *Issues of AI:*

Practical difficulties in building brain like machine, ethics and social issues of AI, philosophical issues of AI – will computers control the human?

### **L02 Implement an intelligent system using a technique of the top-down approach of AI**

#### *Choose and develop skill on a development tool or programming language which support top-down approach:*

Introduction to the language or tool; a quick tour of the language or tool; investigate and develop skill on functions, classes, libraries and/or packages which support the top-down approach.

#### *Choose a technique from the list below, then investigate and demonstrate the technique using the programming language or a tool:*

Knowledge based system: data representation, semantic net, rule-based system.

*Fuzzy logic: uncertainty, fuzzy sets, fuzzy inferences, fuzzy rules.*

Natural language processing: NLP techniques, parsing with generations, compositional and lexical semantics, dialogues.

**L03 Implement an intelligent system using a technique of the bottom-up approach of AI**

*Choose and develop skill on a development tool or programming language which support bottom-up approach:*

Introduction to the language or tool; a quick tour of the language or tool; investigate and develop skill on functions, classes, libraries and/or packages which support the bottom-up approach.

*Choose a technique from the list below then investigate and demonstrate the technique using the programming language or a tool:*

Artificial neural network: supervised learning algorithms, single perceptron, MLP & backpropagation learning algorithms.

Evolutionary computing: problem model, fitness evaluation, selection method, crossover operator, evolution scheme, observation.

Swarm intelligence: swarm intelligent approaches, swarm robotics, team size and composition, team configurability, communication pattern and range.

**L04 Investigate and discuss a range of emerging AI technologies to determine future changes in industry**

*Distributed AI; GPU AI; Ambient AI; Brain Computer Interfacing; Smart Systems, Smart Home and Smart Cities.*

## Learning Outcomes and Assessment Criteria

Pass		Merit	Distinction
<b>LO1</b> Analyse the theoretical foundation of artificial intelligence, current trends and issues to determine the effectiveness of AI technology			<b>D1</b> Discuss how AI might change an individual's lifestyle in the future.
<b>P1</b> Investigate the top-down approach of AI and its techniques, and show how these techniques have been used to build intelligent systems.  <b>P2</b> Investigate the bottom-up approach of AI and its techniques, and show how these techniques have been used to build intelligent systems.	<b>M1</b> Discuss how AI has changed the world in the last two decades and evaluate the ethical, social and philosophical issues of AI.		
<b>LO2</b> Implement an intelligent system using a technique of the top-down approach of AI			<b>D2</b> Develop an outstanding intelligent system based on a top-down approach to overcome a real-world issue.
<b>P3</b> Develop an intelligent system using a top-down approach with a suitable programming language or tool.  <b>P4</b> Test the system and analyse the results against expected results to identify consistencies.	<b>M2</b> Critically evaluate the effectiveness of the intelligent system and suggest methods of improvement.		
<b>LO3</b> Implement an intelligent system using a technique of the bottom-up approach of AI			<b>D3</b> Develop an outstanding, intelligent system based on a bottom-up approach to overcome a real-world issue.
<b>P5</b> Develop an intelligent system using a bottom-up approach with a suitable programming language or tool.  <b>P6</b> Test the system and analyse the test results against expected results to identify consistencies.	<b>M3</b> Critically evaluate the effectiveness of the intelligent system and suggest methods of improvement.		



Pass	Merit	Distinction
<b>LO4</b> Investigate and discuss a range of emerging AI technologies to determine future changes in industry		<b>D4</b> Discuss how emerging AI technology might change our future.
<b>P7</b> Investigate and chose an emerging AI technology and demonstrate how it works.	<b>M4</b> Critically evaluate the industrial and social implications of an emerging AI technology.	

## Recommended Resources

### Textbooks

- Engelbrecht, A. (2007) *Computational Intelligence: An Introduction*. Wiley-Blackwell.
- Jain, A. (2011) *Introduction to Biometrics*. Springer.
- Fankhauser, W. (2015) *Artificial Intelligence Applications: Natural Language Processing*. CreateSpace Independent Publishing Platform.
- Frankish, K. and Ramsey, W. (2014) *The Cambridge Handbook of Artificial Intelligence*. Cambridge: Cambridge University Press.
- Klette, R. (2014) *Concise Computer Vision: An Introduction into Theory and Algorithms*. Springer.
- Picon, A. (2015) *Smart Cities: A Spatialised Intelligence*. AD Primer. John Wiley & Sons.
- Vaden, L. (2015) *Advanced Topics in Brain-Computer Interfacing*. CreateSpace Independent Publishing Platform.
- Warwick, K. (2011) *Artificial Intelligence: The Basics*. Routledge.

### Websites

<a href="http://archive.ics.uci.edu/ml">archive.ics.uci.edu/ml</a>	University of California, Irvine "Machine Learning Repository" (Data sets)
<a href="http://www.codechef.com">www.codechef.com</a>	CodeChef educational initiative "List of Compilers" (Wiki)
<a href="http://www.lfd.uci.edu">www.lfd.uci.edu</a>	University of California, Irvine – Laboratory for Fluorescence Dynamics "Binaries for Python Extension Packages" (Development Tool)
<a href="http://cran.r-project.org">cran.r-project.org</a>	The R Project for Statistical Computing "R Archive Network" (Development Tool)
<a href="http://julia-lang.org">julia-lang.org</a>	Julia Programming Language (Development Tool)
<a href="http://pkg.julia-lang.org">pkg.julia-lang.org</a>	Julia Programming Language (Development Tool)
<a href="http://www.cs.waikato.ac.nz">www.cs.waikato.ac.nz</a>	University of Waikato – Machine Learning Group "Data Mining Software in Java" (Development Tool)
<a href="http://www.knime.org">www.knime.org</a>	Konstanz Information Miner "KNIME" (Development Tool)
<a href="http://azure.microsoft.com">azure.microsoft.com</a>	Microsoft Azure (Development Tool)
<a href="http://accord-framework.net">accord-framework.net</a>	Accord.NET Framework (Development Tool)
<a href="http://www.swi-prolog.org">www.swi-prolog.org</a>	SWI-Prolog (Development Tool)
<a href="http://common-lisp.net">common-lisp.net</a>	The Common Lisp Foundation "Common-Lisp.NET" (Development Tool)

<a href="http://www.aforgenet.com">www.aforgenet.com</a>	Open source C# framework "AForge.NET" (Development Tool)
<a href="http://www.nltk.org">www.nltk.org</a>	Natural Language Toolkit "NLTK" (Development Tool)
<a href="http://www.alicebot.org">www.alicebot.org</a>	ALICE A.I. Foundation "AIML: Artificial Intelligence Markup Language" (Development Tool)
<a href="http://www.orocos.org">www.orocos.org</a>	The OrocOS Project "Open Robot Control Software" (Development Tool)
<a href="http://www.microsoft.com">www.microsoft.com</a>	Microsoft "Robotics Developer Studio" (Development Tool)

## Links

This unit links to the following related units:

*Unit 26: Machine Learning*

# Unit 28: Prototyping

**Unit code** D/615/1666

**Unit level** 5

**Credit value** 15

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## Introduction

A prototype is the first or early sample, model or demonstration version of a concept, design or idea used to test functionality and gather feedback. The objective of prototyping is to build a functional and demonstrable version of a concept and use this version to evaluate different aspects of the concept with end users. A prototype may test a single or multiple facets of a concept and can range in functionality from very basic design mock-ups to fully functional features within complex software applications.

This unit introduces students to the role, basic concepts and benefits of prototyping in the design and development process of software applications. The aim of this unit is to enhance a student's understanding of the methodology, terminology and benefits of prototyping in the design and development of secure software applications.

Among the topics included in this unit are: classification and terminology of prototyping tools and techniques, the relationship between prototypes and release candidate software applications, how prototypes differ from release candidate software applications, categorising prototypes by their intended target end user, functionality and testing requirements, methods of prototyping, most appropriate forms of prototype for the different categories of testing, gathering meaningful insights and results from prototype testing, software release lifecycle and software prototyping concepts.

On successful completion of this unit students will be able to explain the basic concepts of prototyping; plan, build and measure the success of an appropriate prototype with a specific end user in mind; and conduct testing to gather meaningful feedback and data to improve a prototype or final software application.

As a result they will develop skills such as communication literacy, team working, critical thinking, analysis, reasoning and interpretation, business skills, computer software literacy and language, which are crucial for gaining employment and developing academic competence.

## Learning Outcomes

By the end of this unit students will be able to:

- LO1. Explore forms of prototypes appropriate for various functionality and end user testing requirements.
- LO2. Plan a prototype for specific target end users and planned tests.
- LO3. Develop multiple iterations of the prototype using appropriate tools.
- LO4. Evaluate user feedback and test results from multiple iterations of the prototype and end user testing.

## Essential Content

### L01 Explore forms of prototypes appropriate for various functionality and end user testing requirements

*Explore formats, characteristics and appropriateness of prototyping:*

Present an overview of prototyping, how prototypes are produced and their appropriate use in software development.

Identify what a prototype is by researching the role, purpose, terminology and methodology of prototyping.

Recognise the various forms of prototyping by researching the history of prototyping, current trends and use in the product development lifecycle.

Define the characteristics of a prototype by investigating how they can be used and how they differ from complete applications.

Recognise the use of appropriate prototyping formats to achieve specific end user testing requirements and outcomes.

*Recognise specific forms of prototyping functionality and end user testing requirements:*

Research, debate and agree current functionality and end user testing trends and appropriate prototyping methodology.

Identify various forms of functionality and end user testing methodology.

Define the advantages and disadvantages of using prototyping to perform end user testing.

*Define standard tools available for use in prototyping:*

Identify standard tools available to develop prototypes.

The advantages and disadvantages of prototyping tools.

How prototyping tools can be used to rapidly iterate prototypes and capture end user feedback.

Appropriateness of various tools for different end user and functionality testing requirements.

### L02 Plan a prototype for specific target end users and planned tests

*Identify a specific end user and an appropriate prototyping methodology to test with this user type:*

Choose a specific end user to conduct tests against.

Evaluate the benefits, features, advantages and disadvantages of different prototyping methodologies for various end user testing outcomes.

Review different end user categorisations, classifications and behaviour modelling techniques.

Select the most appropriate form of prototyping to achieve desired end user testing and outcomes to ensure the production of a secure end product.

*Describe a plan to use appropriate prototyping methodology and tools to conduct end user testing:*

Apply end user classification and behaviour modelling to select an appropriate prototyping methodology.

Outline the end user characteristics, desired testing criteria and results your prototype addresses.

Select an appropriate form of prototyping necessary to achieve desired results.

Use your selected end user, appropriate prototyping methodology and desired testing criteria to create a prototyping plan.

### **L03 Develop multiple iterations of the prototype using appropriate tools**

*Utilise appropriate tools to develop multiple prototypes:*

Employ an appropriate set of tools to develop your plan into a prototype.

Run end user experiments and examine feedback.

Reconcile and evaluate end user feedback and build a new iteration of your prototype modified with the most important feedback and enhancements.

Make multiple iterations of your prototype and modify each iteration with enhancements gathered from user feedback and experimentation.

### **L04 Evaluate user feedback and test results from multiple iterations of the prototype and end user testing**

*Assess the success of your prototype:*

Assemble and appraise end user feedback from multiple iterations of your prototype.

Undertake a critical review and compare your final prototype and your test results with the original plan.

Evaluate the advantages, disadvantages, strengths and weaknesses of your prototyping methodology.

Critique the overall success of your prototype and discuss your insight using prototyping.

## Learning Outcomes and Assessment Criteria

Pass		Merit	Distinction
<b>LO1</b> Explore forms of prototypes appropriate for various functionality and end user testing requirements			<b>LO1 &amp; LO2</b>  <b>D1</b> Evaluate the impact of common prototyping methodology within the software development lifecycle.
<b>P1</b> Recognise specific forms of prototyping functionality and end user testing requirements.  <b>P2</b> Evaluate standard tools available for use in prototyping.	<b>M1</b> Review specific forms of prototyping and the advantages and disadvantages of end user testing requirements for appropriateness to different testing outcomes.		
<b>LO2</b> Plan a prototype for specific target end users and planned tests			
<b>P3</b> Review different end user categorisations, classifications and behaviour modelling techniques.  <b>P4</b> Explore a specific end user and an appropriate prototyping methodology to test with this user type.	<b>M2</b> Apply end user classification and behaviour modelling to select an appropriate prototyping methodology.  <b>M3</b> Suggest a plan to use appropriate prototyping methodology and tools to conduct end user testing.		
<b>LO3</b> Develop multiple iterations of the prototype using appropriate tools			<b>D2</b> Create multiple iterations of your prototype and modify each iteration with enhancements gathered from user feedback and experimentation.
<b>P5</b> Explore appropriate tools to develop multiple prototypes.  <b>P6</b> Perform end user experiments and examine feedback.	<b>M4</b> Employ an appropriate set of tools to develop your plan into a prototype.  <b>M5</b> Using end user feedback build a new iteration of your prototype modified using the most important feedback and enhancements.		

Pass	Merit	Distinction
<b>L04</b> Evaluate user feedback and test results from multiple iterations of the prototype and end user testing		<b>D3</b> Critique the overall success of your prototype and discuss your insight using prototyping.
<b>P7</b> Analyse end use feedback from multiple iterations of your prototype.	<b>M6</b> Undertake a critical review and compare your final prototype and your test results with your original plan.	



## Recommended Resources

### Textbooks

Hanington, B. (2013) *Universal Methods of Design: 100 Ways to Research Complex Problems, Develop Innovative Ideas, and Design Effective Solutions*. Rockport Publishers.

Kalbach, J. (2015) *Mapping Experiences: A Complete Guide to Creating Value through Journeys, Blueprints, and Diagrams*. 1st Ed. O'Reilly Media.

Lidwell, W. (2010) *Universal Principles of Design, Revised and Updated: 125 Ways to Enhance Usability, Influence Perception, Increase Appeal, Make Better Design Decisions, and Teach through Design*. 2nd Ed. Rockport Publishers.

Osterwalder, A. (2015) *Value Proposition Design: How to Create Products and Services Customers Want*. 1st Ed. Wiley.

Warfel, T. Z. (2009) *Prototyping a Practitioner's Guide*. 1st Ed. Rosenfield Media.

### Links

This unit links to the following related units:

*Unit 1: Programming*

*Unit 9: Software Development Lifecycles*

*Unit 20: Advanced Programming*

# Unit 29: Application Program Interfaces

**Unit code** M/615/1669

**Unit level** 5

**Credit value** 15

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## Introduction

Many applications in use today are a composite of other software. This is true of an application, be it web based, mobile or on a desktop where the functionality of another is used to build upon. Think of an application that locates nearby restaurants – this may utilise an already existing map service as its basis. Or a game application that enables players to invite other players, chat and post high scores to social media all within the game environment. How an application interacts with another is through an Application Program Interface (API).

Typically, APIs consist of methods and tools which are developed by the software author and can provide services and functionality to other application developers without having to 'reinvent the wheel'. Existing APIs provide a huge range of functionality which can be integrated into an application by following the rules of the relevant API. One of the benefits in using APIs is access to existing and proven services that can help speed up development and help standardisation.

The aim of this unit is to introduce students to the nature of APIs by developing proof-of-concept application that utilises existing APIs for common tasks that can include communication, displaying interactive visuals, audio playback and handling a range of user inputs.

Among the topics included in this unit are: identifying what an API is and the need for APIs; types of APIs; application design and development utilising relevant APIs in a suitable development environment; testing of the application; and a critical review of the APIs used.

On successful completion of this unit students will be able to identify and select relevant APIs to use within an application of their own choice or from a given scenario, in addition to testing and documenting the review process against the initial design requirement.

As a result students will develop skills such as communication literacy, critical thinking, analysis, reasoning and interpretation, which are crucial for gaining employment and developing academic competence.

## Learning Outcomes

By the end of this unit students will be able to:

- LO1. Examine what an API is, the need for APIs and types of APIs.
- LO2. Apply the knowledge of API research to design an application that incorporates relevant APIs for a given scenario or a substantial student chosen application.

- LO3. Implement an application in a suitable development environment.
- LO4 Document the testing of the application, review and reflect on the APIs used.

## Essential Content

### **L01 Examine what an API is, the need for APIs and types of APIs**

Research existing APIs, their role and the need for an API.

Identify types of API uses e.g. visual, social media, device manipulation.

Critically evaluate suitable APIs for use in an application (web/mobile/desktop) for a given scenario or a substantial student chosen application.

### **L02 Apply the knowledge of API research to design an application that incorporates relevant APIs for a given scenario or a substantial student chosen application**

Develop relevant wireframes diagrams, concept the design of the application.

Consider the application design/its purpose.

Consider the target platform (web/mobile/desktop).

Identify the scope of the application.

Justify the selection/relevancy/purpose of the chosen APIs for the application.

Take the security of APIs into consideration.

### **L03 Implement an application in a suitable development environment**

Develop the application based on L02.

Consider the use of a suitable development environment.

Utilise best practices for implementing the application.

### **L04 Document the testing of the application, review and reflect on the APIs used**

Document the testing procedure carried out to satisfy the design requirements/purpose of application.

Review/reflect on the application development process; identifying the chosen APIs strengths weaknesses, ease of use, access to features within the APIs.

## Learning Outcomes and Assessment Criteria

Pass		Merit	Distinction
<b>LO1</b> Examine what an API is, the need for APIs and types of APIs			<b>D1</b> Evaluate potential security issues surrounding APIs
<b>P1</b> Examine the relationship between an API and a software development kit (SDK).	<b>M1</b> Assess a range of APIs for a particular platform that covers a range of uses.		
<b>LO2</b> Apply the knowledge of API research to design an application that incorporates relevant APIs for a given scenario or a substantial student chosen application			<b>D2</b> Create a design for a chosen substantial application that will utilise a range of APIs, justifying choices.
<b>P2</b> Analyse an existing application that could be extended with a suitable API.	<b>M2</b> Design an application that will utilise an API for a given purpose.		
<b>LO3</b> Implement an application in a suitable development environment			<b>D3</b> Construct an application utilising multiple APIs, following the designs in LO2.
<b>P3</b> Build on an existing application framework to implement an API.	<b>M3</b> Develop an application that utilises an API.		
<b>LO4</b> Document the testing of the application, review and reflect on the APIs used			<b>D4</b> Critically evaluate the APIs used within your application. Provide a data security report of your application.
<b>P4</b> Design and complete a 'white box' test of the application, recording the results.	<b>M4</b> Conduct 'black box' tests of your application, recording the results. <b>M5</b> Update the application accordingly with the results.		

## Recommended Resources

### Textbooks

Spencer, T. et al. (2015) *Securing the API Stronghold: The Ultimate Guide to API Security*. 1st Ed. Kindle. Amazon.

### Websites

<a href="http://www.khronos.org">www.khronos.org</a>	The Khronos Group "Vulkan API" (Development Tool)
<a href="http://developers.google.com">developers.google.com</a>	Google Developers (Development Tools)

### Links

This unit links to the following related units:

*Unit 9: Software Development Lifecycles*

*Unit 30: Application Development*

# Unit 30: Application Development

**Unit code** H/615/1670

**Unit level** 5

**Credit value** 15

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## Introduction

Software drives business and developers drive software – the world is reliant on software, and programming is at the heart of this. Professionalism and critical thinking, supported by an ability to work independently and as part of a team are core skills of a developer. If you can think logically and you enjoy exploring and dismantling problems, working with others to consider requirements and creating ideas and possible solutions you can gain the experience and learn the skills needed to excel as an Application Developer.

This unit introduces students to Application Development and is designed to simulate the roles and responsibilities of a commercial developer working in a suitable business environment with access to a small team of colleagues. Initially, students are introduced to a business-related problem and will need to adopt and use appropriate methods and practices to analyse, break down and discuss the issues – then, decide, design, create and test a possible solution. Students should be free to debate, evaluate and select different design and development methodologies depending on their own judgement and consideration. On completion, students will be expected to formally evaluate their final application against their design plans and initial requirements.

Among the topics included in this unit are: design and developer documentation; problem analysis; research, system and user requirements; design methodologies and principles; security considerations; development methodologies; Unified Modelling Language (UML), software development lifecycles; teamwork, peer-reviews, development tools and techniques; integrated development environments; debugging, testing, software versions and quality assurance.

On successful completion of this unit students will be able to produce a Software Design Document by analysing a business-related problem and deduce an appropriate solution, including a set of initial requirements, select and use design and development methodologies with tools and techniques associated with the creation of a business application, work individually and as part of a team to plan, prepare and produce a functional business application with support documentation and assess and plan improvements to a business application by evaluating its performance against its Software Design Document and initial requirements.

As a result they will develop skills such as communication literacy, critical thinking, analysis, reasoning and interpretation, which are crucial for gaining employment and developing academic competence.

## Learning Outcomes

By the end of this unit students will be able to:

- LO1. Produce a Software Design Document by analysing a business-related problem and deduce an appropriate solution including a set of initial requirements.
- LO2. Use design and development methodologies with tools and techniques associated with the creation of a business application.
- LO3. Work individually and as part of a team to plan and produce a functional business application with support documentation.
- LO4. Evaluate the performance of a business application against its Software Design Document and initial requirements.



## Essential Content

### **L01 Produce a Software Design Document by analysing a business-related problem and deduce an appropriate solution including a set of initial requirements**

*Analyse a business-related problem and assess possible solutions:*

Discuss and produce a problem definition statement to highlight and describe the issues that need to be addressed.

Research and consider possible solutions and predict the overall success of the application.

*Produce a Software Design Document:*

Review and discuss the value of Software Design Documents with regards to application development.

Evaluate your possible solutions and synthesise the ideas into a single document that identifies and attempts to solve the business-related problem.

Research and use information relating to software testing to create a suitable test plan for your business application.

### **L02 Use design and development methodologies with tools and techniques associated with the creation of a business application**

*Discuss different design and development methodologies:*

Present overviews on current design and development methodologies.

Debate various strengths and weaknesses commonly associated with each methodology.

Select or synthesise a design and development methodology for use with the creation of your application.

Consider the security implications of design and development methodologies.

*Use appropriate tools and techniques:*

Evaluate different tools and techniques available to create a business application.

Debate the advantages and disadvantages of your preferred or selected tools and techniques.

**L03 Work individually and as part of a team to plan and produce a functional business application with support documentation**

*Work as a small team to plan and prepare your business application:*

Peer-review and debate your development plan by effectively communicating and defending the ideas in your Software Design Document.

Discuss differences with regards to the possible strengths and weakness of each Software Design Document.

Modify your Software Design Document to reflect any new insights or considerations.

*Prepare and produce a functional business application:*

Use your Software Design Document with your preferred design and development methodology and your selected tools and techniques to develop a functional business application.

Create and quality check appropriate support documents for your application.

**L04 Evaluate the performance of a business application against its Software Design Document and initial requirements**

Assess the performance of a business application:

Analyse factors that influence the performance of a business application with regard to its system requirements.

Undertake a critical review of the performance and development of your application against all identified factors and any adopted design and development methodologies.

Measure the overall success of the application against your original prediction and identify any new areas of personal insight.

*Plan improvements to a business application:*

Evaluate the overall strengths and weaknesses of your business application against its Software Design Document and initial requirements.

Discuss and plan in detail possible revisions (including implementation) with regard to improving your application's performance.

## Learning Outcomes and Assessment Criteria

Pass		Merit	Distinction
<b>LO1</b> Produce a Software Design Document by analysing a business-related problem and deduce an appropriate solution including a set of initial requirements			<b>LO1 &amp; LO2</b>  <b>D1</b> Justify the tools and techniques chosen to realise a custom built website. Justify your preferred selection of tools and techniques in deducing an appropriate solution to a business related problem.
<b>P1</b> Explore a business-related problem and produce a well-defined Problem Definition Statement supported by a set of user and system requirements.  <b>P2</b> Determine any areas of risk related to the successful completion of your application.	<b>M1</b> Analyse a business-related problem using appropriate methods and produce a well-structured Software Design Document that defines a proposed solution and includes relevant details on requirements, system analysis, system design, coding, testing and implementation.		
<b>LO2</b> Use design and development methodologies with tools and techniques associated with the creation of a business application			
<b>P3</b> Research the use of software development tools and techniques and identify any that have been selected for the development of this application.	<b>M2</b> Compare the differences between the various software development tools and techniques researched and justify your preferred selection as well as your preferred software development methodology.		
<b>LO3</b> Work individually and as part of a team to plan and produce a functional business application with support documentation			<b>D2</b> Evaluate any new insights, ideas or potential improvements to your system and justify the reasons why you have chosen to include (or not to include) them as part of this business application.
<b>P4</b> Create a formal presentation that effectively reviews your business application, problem definition statement, proposed solution and development strategy. Use this presentation as part of a peer-review and document any feedback given.	<b>M3</b> Interpret your peer-review feedback and identify opportunities not previously considered.  <b>M4</b> Develop a functional business application based on a specific Software Design Document with supportive evidence of using the preferred tools, techniques and methodologies.		

Pass	Merit	Distinction
<b>P5</b> Develop a functional business application based on a specified business problem.		
<b>LO4</b> Evaluate the performance of a business application against its Software Design Document and initial requirements		
<b>P6</b> Review the performance of your business application against the Problem Definition Statement and initial requirements.	<b>M5</b> Analyse the factors that influence the performance of a business application and use them to undertake a critical review of the design, development and testing stages of your application. Conclude your review by reflectively discussing your previously identified risks.	<b>D3</b> Critically evaluate the strengths and weaknesses of your business application and fully justify opportunities for improvement and further development.

## Recommended Resources

### Textbooks

Carmen, T. et al. (2009) *Introduction to Algorithms*. USA: MIT Press.

Martin, R.C. (2011) *The Clean Coder: A Code of Conduct for Professional Programmers*. USA: Prentice Hall.

McConnell, S. (2004) *Code Complete: A Practical Handbook of Software Construction*. USA: Microsoft Press.

### Links

This unit links to the following related units:

*Unit 6: Managing a Successful Computing Project*

*Unit 9: Software Development Lifecycles*

# Unit 31: Games Engine & Scripting

Unit code	K/615/1671
Unit level	5
Credit value	15

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## Introduction

Professional game development typically represents a significant investment in time, effort, skill and money. These requirements are further complicated due to the generally increasing differences in hardware platforms (such as PCs, Mac, Xbox, PlayStation, tablets and other mobile devices). Prior to the use of a games engine, a developer would need highly detailed and specific knowledge relating to the platform, device drivers and operating system calls. In addition, they would need to be capable of writing efficient low-level maths functions to simulate physics, gravity, calculate trajectories and determine object collisions in 2D and 3D environments, including designing image transition algorithms. Using a games engine, a developer can implement more features, more quickly and more effectively, and deploy them on more platforms than ever before. However, despite using a games engine there are still plenty of unique challenges to be solved.

This unit introduces students to the origin and evolution of games engines and their effect on game design, it also expects students to project this path into the future to draw conclusions and predict a possible future for engines. After being introduced to the core services of most engines and their advantages, students are expected to evaluate a range of different engines and debate their features. In addition, and while students assimilate, reflect and consider the advantages and technical challenges of a games engine they will be issued with an existing Games Design Document (supported with all appropriate assets) and challenged with planning and using a specific engine to develop the design into a functional game. On completion, and in addition to the student reviewing and reflecting on the experience, they will be expected to formally assess their functional game against the Games Design Document and user expectation.

Among the topics included in this unit are: games engine evolution and purpose, player expectation, types of engine, design documentation, research, system and user requirements, game design, ad management, monetisation, usage analytics, build services, graphics and animation, adding physics, storing world data, artificial and automated intelligence, collision detection, user interface and user control methods, gameplay, assets and asset management, hardware platforms, development tools and techniques, integrated development environments, scripting languages, debugging, testing, software versions and quality assurance.

On successful completion of this unit students will be able to analyse the evolution, impact and possible future of games engines with regard to game development and expectation, evaluate the features and architecture of different games engines, use an existing Game Design Document (with assets) to synthesise key features of a selected games engine into a playable game and assess and plan improvements to a playable game by evaluating its performance against its Game Design Document and user expectation.

As a result they will develop skills such as communication literacy, critical thinking, analysis, reasoning and interpretation, which are crucial for gaining employment and developing academic competence.

## **Learning Outcomes**

By the end of this unit students will be able to:

- LO1. Analyse the evolution, impact and possible future of games engines with regards to game development and expectation.
- LO2. Evaluate the features and architecture of different games engines.
- LO3. Use an existing Game Design Document (with assets) to synthesise key features of a selected games engine into a playable game.
- LO4. Assess and plan improvements to a playable game by evaluating its performance against its Game Design Document and user expectation.

## Essential Content

### L01 Analyse the evolution, impact and possible future of games engines with regards to game development and expectation

*Analyse the evolution of games engines:*

Identify what a games engine is by researching the purpose and history of games engines.

Assemble and evaluate a timeline illustrating milestones and linking the release of pivotal games with the development and use of games engines.

*Investigate the possible future of games engines with regards to games development and expectation:*

Research, debate and agree current gaming trends.

Discuss the evolution of player expectation and its influence and effect on games development.

Analyse trends and use the information to predict a possible future for games (short, mid and long term) and relate this to the development and use of games engines.

### L02 Evaluate the features and architecture of different games engines

*Features and architecture of a games engine:*

Introduce and discuss the core features of games engines, such as: ad management, monetisation, usage analytics, build services, multiplayer support, developer collaboration, debugging, 2D and 3D graphics and animation services, particle and lighting systems, physics and database services, multiple language support, virtual reality, artificial and automated intelligence, collision detection, user interface and user control methods.

Select a specific games engine and discuss game engine architecture, including: game and update loops, assets and memory management, graphics manipulation, scripting, collisions and physics engine, math libraries and user interface.

Evaluate a range of different types of published games to determine and agree the type of features commonly embedded in each.

Use your selected games engine to investigate the implementation and technical challenges associated with each of your previously identified features.

*Research different games engines:*

Debate the features from a range of games engines and evaluate the strengths and weaknesses of each.



**L03 Use an existing Game Design Document (with assets) to synthesise key features of a selected games engine into a playable game**

*Synthesise ideas defined in an existing Game Design Document with games engine features:*

Evaluate and synthesise an existing Game Design Document with the features of a specific games engine to create a development plan.

Peer-review and discuss your development plan by effectively communicating and defending your ideas and reasoning.

Modify your plan to reflect any new insights or considerations.

*Create and test a playable game:*

Use the Game Design Document (with assets) with your development plan to create a playable game.

Adopt an appropriate level of testing to identify, debug and fix issues.

**L04 Assess and plan improvements to a playable game by evaluating its performance against its Game Design Document and user expectation**

*Assess the performance of a playable game:*

Analyse factors that influence the performance of a playable game with regard to game genre, style and player expectation.

Undertake a critical review of the performance and development of your playable game against all identified factors, including use of any games engine features.

Critique the overall success of your playable game and identify any new areas of personal insight.

*Plan improvements to a playable game:*

Evaluate the overall strengths and weaknesses of your playable game against its Game Design Document.

Discuss and plan in detail possible revisions (including implementation) with regard to improving your playable game's performance.

## Learning Outcomes and Assessment Criteria

Pass		Merit	Distinction
<b>LO1</b> Analyse the evolution, impact and possible future of games engines with regards to game development and expectation			<b>LO1 &amp; LO2</b>  <b>D1</b> Critically analyse each of the games engines evaluated in M3.
<b>P1</b> Compare different games engines and explain how their evolution has impacted on game design and development.	<b>M1</b> Discuss the origin, type and chronological evolution of games engines, associating them with influential titles that had a significant impact on video game design and development and explain how this affected player expectation.  <b>M2</b> Provide evidence of current gaming trends and technology and use it to predict the future of games engines and explain how this could affect designers, developers and gamers.		
<b>LO2</b> Evaluate the features and architecture of different games engines			
<b>P2</b> Compare the features of different games engines and explain the purpose and operation of each.  <b>P3</b> Review different published games and determine the types of features embedded in each against the features available in a selected games engine.	<b>M3</b> Evaluate the features and architecture of different games engines and explain with technical detail the purpose and operation of each.  <b>M4</b> Use a selected games engine to create simple prototypes that demonstrate features commonly embedded in games.		

Pass	Merit	Distinction
<b>LO3</b> Use an existing Game Design Document (with assets) to synthesise key features of a selected games engine into a playable game.		<b>D2</b> Further expand your playable game by adding support for: animation, sound, end of level detection, player victory and loss conditions and level restarting.
<b>P4</b> Use an existing Games Design Document to plan the development and testing of a playable demo and conduct formal peer-reviews regarding your development and testing plan, documenting any feedback given.  <b>P5</b> Use a Games Design Document supported with a development and test plan and a selected games engine to develop a playable demo.	<b>M5</b> Interpret your peer-review feedback and identify opportunities not previously considered.  <b>M6</b> Extend your playable demo into a game that supports: splash screens, credits, scoring and losing player life.	
<b>LO4</b> Assess and plan improvements to a playable game by evaluating its performance against its Game Design Document and user expectation		<b>D3</b> Critically evaluate the strengths and weaknesses of your playable game against player expectation and explain opportunities for improvement and further development.
<b>P6</b> Review the performance of your playable demo or game against the Games Design Document.	<b>M7</b> Evaluate the strengths and weaknesses of your playable game against player expectation.	

## Recommended Resources

### Textbooks

Gibson, J. (2014) *Introduction to Game Design, Prototyping, and Development*. New Jersey: Pearson Education.

Gregory, J. (2014) *Game Engine Architecture*. United States: Taylor.

Madhav, S. (2013) *Game Programming Algorithms and Techniques*. USA: Addison-Wesley.

Nystrom, R. (2014) *Game Programming Patterns*. USA: Genever Benning.

Rogers, S. (2014) *Level Up! The Guide to Great Video Game Design*. UK: John Wiley and Sons Ltd.

Schell, J. (2014) *The Art of Game Design: A Book of Lenses*. USA: A K Peters/CRC Press.

### Links

This unit links to the following related units:

*Unit 32: Game Design Theory*

*Unit 47: Games Development*

# Unit 32: Game Design Theory

<b>Unit code</b>	<b>T/615/1673</b>
<b>Unit level</b>	<b>5</b>
<b>Credit value</b>	<b>15</b>

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## Introduction

What makes a great game? Although it's easy to say, "This is a great game" when your character has just cleared a zone and your friend's voice buzzes in your headset letting you know that everybody is waiting for you to join the party – then another player interrupts suggesting tactics to take down the next objective. However, it is a completely different story when you (the designer) are sitting, staring at a blank sheet of paper and your producer is expecting you to present 'The next big title'.

This unit introduces students to an exploration of the practices, principles and skills needed to successfully design a game. Initially this unit establishes an overall history of games and reviews how they have (and are still) evolving. It also takes the opportunity to introduce and assess common game features and help the students identify the roles, responsibilities and challenges of game design. As part of this unit students will become familiar with a range of standard documents associated with games design including the 'Game Design Document'. Before students embark on defining, designing and documenting their own game ideas they are given opportunities to work in groups to debate and review the elements of game design, introduced to the design process as well as the practices, principles, tools and techniques. As students progress they are given opportunities to evolve their ideas through peer-reviews before finally presenting a 'High Concept' pitch. To help maximise the student involvement, this unit should (where possible) simulate a real-world, design experience.

Among the topics included in this unit are: design documentation, research, requirement gathering, idea generation, world design, storyboards, storytelling, characters, levels, gameplay, assets and asset management, tools and techniques, game engines and environments, genres, game mechanics, player motivation and challenge, rewards, game structure, game design vocabulary, and preparing and presenting a pitch.

On successful completion of this unit students will be able to critically assess the types, practices, principles and skills used in the design of games, analyse the concepts and elements required for the production of a Games Design Document, evaluate the game design process with regards to game development and production and use game design practices and principles to create an original Game Design Document and present a High Concept pitch.

As a result they will develop skills such as communication literacy, critical thinking, analysis, reasoning and interpretation, which are crucial for gaining employment and developing academic competence.

## Learning Outcomes

By the end of this unit students will be able to:

- LO1. Critically assess the types, practices, principles and skills used in the design of games.
- LO2. Analyse the concepts and elements required for the production of a Games Design Document.
- LO3. Evaluate the game design process with regards to game development and production.
- LO4. Use game design practices and principles to create an original Game Design Document and present a High Concept pitch.

## Essential Content

### L01 Critically assess the types, practices, principles and skills used in the design of games

*Review game design and game types:*

Identify what game design is and explore the evolution of games over time.

Research and assess game types, trends, player features, control and technology.

*Investigate the practices, principles and skills used in the design of games:*

Identify the role of a games designer and introduce concepts related to the game design process (including high concept, story and art bible, design document).

Discuss idea generation, world design, storytelling, characters, levels, gameplay, assets and asset management.

Assess the skills needed to successfully design a video game.

### L02 Analyse the concepts and elements required for the production of a Games Design Document

*Investigate Games Design Document structure:*

Review different Game Design Documents and identify common and shared factors.

Discuss, compare and synthesise your identified factors into an agreed format.

*Analyse the concepts and elements required for a Games Design Document:*

Examine the purpose of the Game Design Document (including game loops such as: core, dual and compulsion as well as the principles of Metagame design) and identify the stakeholders and their possible expectations.

Debate the content, depth and quality of information expected in a Games Design Document (including age appropriate content and content ratings).

Explain the strengths and possible weaknesses of a Games Design Document.

### L03 Evaluate the game design process with regards to game development and production

*Introduce key terminologies and define a basic roadmap for the game design process (including: concepts, planning and design, development, testing, distribution):*

Debate the value of the concept stage (including idea generation and establishing the audience, game world, narrative, style, features and gameplay, characters, storyboards and player motivation and challenges).

Recap why concepts are reviewed, synthesised and stored as a set of documents.

Investigate design tools and explore issues related to the planning and design stage (including: asset creation and management and possible redevelopment of agreed ideas).

Introduce game development constraints (and possible pitfalls) together with platforms commonly available to support development.

Discuss testing methods and introduce the purpose of Quality Assurance (QA) and business and monetisation models (e.g. Steam, retail, Free-to-Play (F2P) supported by techniques such as: item-purchase, affiliate, advertising, Freemium, restricted access, subscription) with regards to production and distribution taking security issues into consideration.

**L04 Use game design practices and principles to create an original Game Design Document and present a High Concept pitch.**

*Create an original game concept:*

Gather and document a range of original game ideas using research on existing game types and styles for inspiration.

Peer-review and evaluate feedback on a number of your game ideas to justify the selection of a specific game idea.

Review and apply game design practices and principles to develop a specific game idea into a full, well-structured concept.

*Create an original Game Design Document and present its High Concept pitch:*

Produce and quality check a Game Design Document and High Concept presentation based on your selected concept.

Present and defend your High Concept pitch.



## Learning Outcomes and Assessment Criteria

Pass		Merit	Distinction
<b>LO1</b> Critically assess the types, practices, principles and skills used in the design of games			<b>LO1 &amp; LO2</b>  <b>D1</b> Evaluate each section of a Games Design Document and explain the effect of game loops and Metagame design with regards to game play.
<b>P1</b> Compare different video game types and explain key or influential titles as they were released over time.  <b>P2</b> Research the skills needed to design, create and produce a video game and compare the roles of a games animator, producer, audio engineer, director, designer, programmer and artist.	<b>M1</b> Analyse the evolution of game technology and its impact on video game design and complexity.		
<b>LO2</b> Analyse the concepts and elements required for the production of a Games Design Document			
<b>P3</b> Examine the structure of a Game Design Document.	<b>M2</b> Determine the various needs and expectations of the Game Design Document stakeholders.		
<b>LO3</b> Evaluate the game design process with regards to game development and production			<b>D2</b> Evaluate the importance and issues related to idea generation, audience understanding, world design, narrative, style, features, gameplay, characters, storyboards and player motivation and challenge with regards to game design.
<b>P4</b> Create an illustrated guide explaining the video game design, development and production processes, including an evidence-based comparison between 'AAA' and 'Indie' (independent) budget allocation and development timelines.  <b>P5</b> Compare different business and monetisation models used with games production and distribution.	<b>M3</b> Analyse different game distribution channels and marketing methods used in games production.		

Pass	Merit	Distinction
<b>LO4</b> Use game design practices and principles to create an original Game Design Document and present a High Concept pitch		<b>D3</b> Critically evaluate the strengths and weaknesses of your finished video game concept, Design Document and High Concept pitch and fully justify opportunities for improvement and further development.
<b>P6</b> Create an original game concept and maintain organised evidence of giving appropriate and constructive feedback to others.  <b>P7</b> Develop an original Game Design Document and High Concept presentation.	<b>M4</b> Conduct peer-reviews using your original game concept and document any feedback given.  <b>M5</b> Develop a detailed, original Game Design Document and formally present and defend your High Concept pitch.	

## Recommended Resources

### Textbooks

Gibson, J. (2014) *Introduction to Game Design, Prototyping, and Development*.

New Jersey: Pearson Education.

Gregory, J. (2014) *Game Engine Architecture*. United States: Taylor.

Madhav, S. (2013) *Game Programming Algorithms and Techniques*. USA: Addison-Wesley.

Nystrom, R. (2014) *Game Programming Patterns*. USA: Genever Benning.

Rogers, S. (2014) *Level Up! The Guide to Great Video Game Design*. UK: John Wiley and Sons Ltd.

Schell, J. (2014) *The Art of Game Design: A Book of Lenses*. USA: A K Peters/CRC Press.

### Links

This unit links to the following related units:

*Unit 9: Software Development Lifecycles*

*Unit 31: Games Engine & Scripting*

*Unit 47: Games Development*

# Unit 33: Analytical Methods

**Unit code** F/615/1675

**Unit level** 5

**Credit value** 15

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## Introduction

John von Neumann, a Hungarian mathematician, outlined the architecture for a stored-program computer in a paper he wrote in 1945. In order to fully develop new software and hardware technologies within this architecture, analytical skills and techniques needed to be applied to any proposed design. In the modern era, analytical methods still underpin theoretical computer science fundamentals, and developing this mathematical knowledge will support development in many aspects of computing.

This unit introduces students to more advanced analytical techniques that are relevant to them as they progress within their studies in computing, and advances knowledge of mathematical modelling and application of theory.

Among the topics included in this unit are: complex numbers, numerical methods, matrices, formal logic and Z specification.

On successful completion of this unit students will be able to use applications of complex number theory, approximate solutions of contextualised examples with numerical methods, apply matrix theory to a variety of different scenarios and use formal methods of logic. As a result they will develop skills such as communication literacy, critical thinking, analysis, reasoning and interpretation, which are crucial for gaining employment and developing academic competence.

## Learning Outcomes

By the end of this unit students will be able to:

- LO1. Examine complex number theory within practical situations.
- LO2. Approximate solutions using numerical methods.
- LO3. Employ matrix methods to contextualised examples relevant to computing.
- LO4. Investigate the concepts of formal methods within computer science.

## Essential Content

### L01 Examine complex number theory within practical situations

#### *Complex number theory:*

Introduction to imaginary numbers and complex numbers.

The modulus, argument and conjugate of complex numbers.

The polar form of complex numbers.

The use of de Moivre's Theorem.

Using quaternions for spatial rotation in computer graphics.

### L02 Approximate solutions using numerical methods

#### *Numerical methods:*

Using sketches to approximate solutions of equations.

Numerical analysis using the bisection method and the Newton–Raphson method.

Numerical integration, the trapezium rule and Simpson's rule.

#### *Analysis:*

Error analysis to determine the accuracy of approximations.

Explanation of numerical method failure and comparison of methodology.

### L03 Employ matrix methods to contextualised examples relevant to computing

#### *Matrix methods:*

Introduction to matrices and matrix notation.

Using matrices to represent ordered data and the relationship with program variable arrays.

The process for addition, subtraction and multiplication of matrices.

Calculating the determinant and inverse of a matrix.

Application of matrices to vector transformations and rotation, maps and graphs.

#### **L04 Investigate the concepts of formal methods within computer science**

*Formal reasoning:*

Logic and proof.

Introduction to Hoare logic.

Hoare logic to assess the correctness of computer programs.

Automated proof checking.

*Z specification language:*

Model-based specification.

The modelling of software systems using Z specification.

Proving properties using Z specification.

## Learning Outcomes and Assessment Criteria

Pass		Merit	Distinction
<b>LO1</b> Examine complex number theory within practical situations			<b>D1</b> Formulate solutions of problems using de Moivre's Theorem.
<b>P1</b> Solve applicable problems using complex number theory.	<b>P2</b> Perform arithmetic operations using the polar and exponential form of complex numbers.	<b>M1</b> Critique the use of quaternions for application in spatial rotation.	
<b>LO2</b> Approximate solutions using numerical methods			<b>D2</b> Appraise the different methodology that is used for numerical integration.
<b>P3</b> Examine the roots of an equation using two different iterative techniques.	<b>P4</b> Determine the numerical integral of functions using two different methods.	<b>M2</b> Select two different examples that show the failure of numerical techniques.	
<b>LO3</b> Employ matrix methods to contextualised examples relevant to computing			<b>D3</b> Determine solutions to a set of linear equations using the inverse matrix method.
<b>P5</b> Utilise matrices to represent ordered data in array form.	<b>P6</b> Perform addition, subtraction and multiplication of matrices.	<b>M3</b> Ascertain the determinant of two different scale matrices.	
<b>LO4</b> Investigate the concepts of formal methods within computer science			<b>D4</b> Judge the correctness of a given computer program using Hoare logic.
<b>P7</b> Interpret the meaning of given logical statements into plain English.	<b>P8</b> Examine the modelling of software systems using Z specification.	<b>M4</b> Use Hoare's notation to model the correctness of a given computer program.	

## Recommended Resources

### Textbooks

- Garnier, R. and Taylor, J. (1992) *Discrete Mathematics: For New Technology*.  
Oxfordshire: Taylor & Francis.
- Stroud, K.A. (2009) *Foundation Mathematics*. Basingstoke: Palgrave Macmillan.

### Journals

- Communications on Pure and Applied Mathematics*. Wiley.

### Links

This unit links to the following related units:

*Unit 14: Business Intelligence*



# **Unit 34: Systems Analysis & Design**

<b>Unit code</b>	<b>L/615/1677</b>
<b>Unit level</b>	<b>5</b>
<b>Credit value</b>	<b>15</b>

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## **Introduction**

The world is constantly changing, with new and emerging digital technologies bringing many challenges to the commercial world. Organisations have to respond to these changes in addition to responding to new markets and different ways of doing their business. The systems they use to run their businesses have to respond quickly to these transformations. Organisations can find themselves in a situation where they have to regularly upgrade old systems or develop new ones in order to continue operating successfully in the evolving competitive business environment.

Before any system can be upgraded or a new system developed, the system requirements have to be analysed and the system designed, whether this is for a database system, or a web, game or mobile application, and failure to do this adequately could lead to a costly systems failure.

This unit explores the processes of systems analysis and design using two methodologies – the traditional systems development lifecycle methodology providing a comprehensive structured framework and the agile methodology with different framework models developed with the emphasis on variations of iterative incremental modelling. To provide perspective, students will examine the models in both these methodologies. They will consider the particular strengths and weaknesses of the two methodologies and examine the suitability of the methodologies using different examples.

Topics included in this unit are: examining the business case for a new system or for upgrading an existing one, looking at traditional and agile systems analysis methodologies and evaluating the merits of each, considering the implications of moving from using the traditional methods of analysis and design to agile methods on analysts, designers and developers in an organisation, and applying systems design tools and techniques.

On successful completion of this unit, students will be able to produce a business case, and analyse a system and its requirements using a suitable methodology. They will be able to design a system suitable for their application. Theoretical understanding will be translated into practical skills through actual systems investigations and students will become confident in the use of particular tools and techniques relevant to the methodology chosen. Although for practical purposes, it is likely that one particular methodology and related tools and techniques will be used, it is important that students understand that others are available.

As a result students will develop skills such as communication literacy, critical thinking, analysis, reasoning and interpretation, which are crucial for gaining employment and developing academic competence.

## **Learning Outcomes**

By the end of the unit students will be able to:

- LO1. Evaluate the strengths and weaknesses of the traditional and agile systems analysis methodologies.
- LO2. Produce a feasibility study for a system for a business-related problem.
- LO3. Analyse their system using a suitable methodology.
- LO4. Design the system to meet user and system requirements.

## Essential Content

### L01 **Evaluate the strengths and weaknesses of the traditional and agile systems analysis methodologies**

Principles of the traditional Systems Development Life Cycle (SDLC) models, including Waterfall, Prototyping, and Spiral.

Principles of agile methodologies models, including Scrum, Extreme, Lean, Scaled Agile Frameworks (SAFe), Disciplined Agile Delivery (DAD), Kanban, Disciplined Agile Delivery (DAD), Agile Modelling (AM) and DevOps, amongst the many variations.

Strengths and weaknesses of traditional and agile methodologies.

Identify transition problems in organisations of moving from traditional to agile methodology.

Factors that need to be considered when selecting the appropriate methodology to use.

### L02 **Produce a feasibility study for a system for a business-related problem**

Elements of a business case.

Desirability, viability and feasibility of systems.

Investigation techniques to use.

Criteria to consider for a business case: vision and goals cost-benefit analysis, legal, economic, technical, operational, timeframes, organisational culture, security considerations.

### L03 **Analyse their system using a suitable methodology**

Tools used to investigate the system.

Identifying user and system requirements and any constraints, including possible security issues.

Identifying the team members and their roles and responsibilities in a project team.

Identifying documentation that will be produced at the different stages and determining the sign-off conditions.

Criteria to use to determine the suitability of the methodology used to analyse the system.

#### **L04 Design the system to meet user and system requirements**

Design elements for the traditional and agile methodologies.

Determining the design features for traditional and agile methodologies.

Data flow diagrams and flow charts.

Determining the tools and techniques relevant for the design of systems for database applications, web applications, games, mobile applications and other software applications.

Identifying the design documentation contents for different application types e.g. for databases, web design, games, mobile and other software applications.

Link to other units relevant for students where systems are being designed and developed.

Design sign-off.

## Learning Outcomes and Assessment Criteria

Pass		Merit	Distinction
<b>LO1</b> Evaluate the strengths and weaknesses of the traditional and agile systems analysis methodologies			<b>LO1 &amp; LO2</b>  <b>D1</b> Critically evaluate the strengths and weaknesses of the traditional and agile systems analysis methodologies, including the transition problems faced by organisations that move from the traditional to the agile approach.
<b>P1</b> Discuss the strengths and weaknesses of the traditional and agile systems analysis methodologies.	<b>M1</b> Compare and contrast the strengths and weaknesses of the traditional and agile systems analysis methodologies.		
<b>LO2</b> Produce a feasibility study for a system for a business-related problem			
<b>P2</b> Produce a feasibility study for a system for a business related problem.	<b>M2</b> Evaluate the relevance of the feasibility criteria on the systems investigation for the business related problem.		
<b>LO3</b> Analyse their system using a suitable methodology			<b>LO3 &amp; LO4</b>  <b>D2</b> Justify the choice of the analysis methodology used in the context of the business problem.
<b>P3</b> Analyse a system using a suitable methodology for a business-related problem.	<b>M3</b> Evaluate the effectiveness of the analysis in the context of the methodology used.		
<b>LO4</b> Design the system to meet user and system requirements			
<b>P4</b> Design a fully functional system to meet user and system requirements for the business related problem.	<b>M4</b> Assess the effectiveness of the system design with particular reference to the methodology used and how the design meets user and system requirements		

## Recommended Resources

### Textbooks

- Ambler, S. and Lines, M. (2012) *Disciplined Agile Delivery (DAD): A Practitioner's Guide to Agile Software Delivery in the Enterprise*. IBM Press.
- Dennis, A. and Wixom, B. (2009) *Systems Analysis and Design*. 4th Ed. International Student Version. John Wiley & Sons.
- Dingsøyr, T., Tore Dybå, T. and Moe, N.B. (eds) (2010) *Agile Software Development: Current Research and Future Directions*. Springer.
- Hoffer, J., George, J. and Valacich, J. (2015) *Essentials of Systems Analysis and Design*. Global Edition. Pearson.
- Hoffer, J., George, J. and Valacich, J. (2013) *Modern Systems Analysis and Design*. Global Edition. Pearson Higher Ed.
- Kenneth, K. and Kendall, J. (2013) *Systems Analysis and Design*. 9th Ed. Pearson.
- Larman, C. (2004) *Agile and Iterative development: A Managers Guide*. Addison-Wesley Professional.
- Martin, R. (2013) *Agile Software Development, Principles, Patterns, and Practice*. New International Edition. Pearson.

### Journals

- The Computer Journal*
- Journal of Systems Analysis and Software Engineering*
- Journal of Emerging Trends in Computing and Information Sciences*

### Websites

- |                   |  |
|-------------------|--|
| agilemodeling.com | Agile Modelling<br>"Agile Analysis" (Article)  |
| www.batimes.com   | Resources for Business Analysts<br>"Applying Agile Principles To Requirement Analysis" (Article) |
| www.sparcedge.com | SPARC<br>"What an Agile Design Process Looks Like" (Article)                                     |
| forty.co          | Forty<br>"Agile design: what we've learned" (Article)  |

### Links

This unit links to the following related units:

- Unit 6: Managing a Successful Computing Project*
- Unit 9: Software Development Lifecycles*

# Unit 35: Network Management

**Unit code** Y/615/1679

**Unit level** 5

**Credit value** 15

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## Introduction

Network Management has become one of the most sought-after skills for government institutions, commercial organisations, financial institutions as well as academic institutions as they try to run their IT networks in a more cost effective, efficient and secure way. The art of Network Management needs to be perfected by those in charge of networks for today and the future. This includes multimedia applications such as VoIP, IPTV and mobile network as well as virtualised environments.

This unit introduces students to simple network Planning, Configurations, Setup, and Management, including LAN, WAN, NAT, PAN, MAN, using a variety of tools and methods for managing Networks, including Network Monitoring, Network Security such as Snort, Firewalls & IPS, Network Protocols and standards such as SNMP, NETCONF, IEEE, MIBII, RMON, MDIB & ANS.1, as well as industry's best practices. Students will also be introduced to Virtual Networks, Network Operating Systems, Risk Management and Cloud Network Management.

Among the topics included in this unit are: Network Planning, Network Configurations, Network Setup and Network Management of LANs, PAN, MAN, WAN, NAT using several tools and methods; Network Monitoring, Network Security, Network Load Balancing, Network Protocols and Standards, Best Practices, Virtualisation, Network Operating Systems, Network Risk Management and Cloud Network Management.

On successful completion of this unit students will be able to plan a network, configure a network, setup a network, manage a network such as a LAN, PAN, MAN, WAN as well as conduct network monitoring, Network Security, network protocols and standards. Students will also be able to apply industry best practices, manage virtualised networks, work with several operating systems vendors and well as plan and manage network risks and cloud computing.

As a result they will develop skills such as communication literacy, critical thinking, analysis, reasoning and interpretation which are crucial for gaining employment and developing academic competence.

## Learning Outcomes

By the end of this unit students will be able to:

- LO1. Explore the concepts and principles of Network Management.
- LO2. Plan, Design, Setup and Configure a network.
- LO3. Justify the Protocols and Standards concerned with Networking and Network Management.
- LO4. Use tools and methods to manage a network, including Network Security and Risk Management.

## Essential Content

### LO1 Explore the concepts and principles of Network Management

Describe Network Management Concepts and Principles which deals effective network management, including different technologies, protocols and activities associated with Networking Management as well as how they relate to one another. You are also required to examine the Networking Management Principles, including self-learning networks, Service Levels Agreements (SLAs) as well as topologies and security.

### LO2 Plan, Design, Setup and Configure a network

*Network Planning:*

Plan a network based on a given scenario.

*Design a network:*

Design a network based on a given scenario.

*Setup a network:*

Setup a network based on a given scenario.

*Configure a Network environment:*

Conduct configurations on your network, including setting up all devices.

### LO3 Justify the Protocols and Standards concerned with Networking and Network Management

*Network Protocols and Standards:*

Protocols: SNMP, NETCONF, RMON, TCP/IP, HTTP, DNS, DHCP, SSL, IPsec.

Standards: IEEE, ITU, ISO, OSI, IANA.

### LO4 Use tools and methods to Manage a Network including Network Security and Risk Management

*Tools and methods:*

NETCONF, CISCO, SNMP, RMON.

*Network Security:*

IPsec, HHTPs, FTPs, DNS, Firewall, Passwords, Cryptography.

*Risk Management:*

Risk Identification, Risk Mitigation, Risk Avoidance, Risk Management.



## Learning Outcomes and Assessment Criteria

Pass		Merit	Distinction
<b>LO1</b> Explore the concepts and principles of Network Management			<b>LO1 &amp; LO2</b> <b>D1</b> Provide a comprehensive network configuration by providing screenshots of your work.
<b>P1</b> Investigate Network Management concepts and principles.	<b>M1</b> Evaluate the importance of Network Management.		
<b>LO2</b> Plan, Design, Setup and Configure a network			
<b>P2</b> Produce a comprehensive design of a network according to a given scenario.	<b>M2</b> Implement a network design according to a predefined network specification.		
<b>LO3</b> Justify the Protocols and Standards concerned with Networking and Network Management			<b>D2</b> Compare and contrast SNMP and RMON.
<b>P3</b> Evaluate the following Network Protocols and Standards: SNMP, NETCONF, RMON, TCP/IP, HTTP, DNS, DHCP, SSL, IPSec, IEEE, ITU, ISO, OSI including IANA and ICANN.	<b>M3</b> Compare and contrast two Protocols.		
<b>LO4</b> Use tools and methods to manage a network, including Network Security and Risk Management			<b>D3</b> Critically evaluate the importance of carrying out a Risk Assessment on a network.
<b>P4</b> Use tools and methods to manage a network.	<b>M4</b> Justify the importance of Network Security in a network.		
<b>P5</b> Implement Network Security on your network.			
<b>P6</b> Conduct a Risk Assessment on your network.			

## Recommended Resources

### Textbooks

- Anderson, A. and Benedetti, R. (2009) *Head First Networking*. O'Reilly Media.
- Aschermann, R. (1999) *MCSE Networking Essentials for Dummies*. Foster City, IDG Books Worldwide.
- Beauchamp, K.G. and Poo, G.S. (1995) *Computer Communications* (now out of print but in library). Thompson.
- Comer, D. and Droms, R. (2003) *Computer Networks and Internets*. 4th Ed. Upper Saddle River: Prentice Hall.
- Fitzgerald, J. and Dennis, A. (2006) *Business Data Communications and Networking*. 9th Ed. Hoboken. John Wiley.
- Hallberg, B. (2005) *Networking: A Beginner's Guide*. 4th Ed. Osborne/McGraw-Hill.
- Hallberg, B. (2013) *Networking: A Beginner's Guide*. 6th Ed. McGraw-Hill Osborne.
- Harrington, J.L. (1999) *Ethernet Networking Clearly Explained*. Morgan Kaufman.
- Kurose, J.F. and Ross, K.W. (2001) *Computer Networking: A Top-Down Approach Featuring the Internet*. London: Addison-Wesley.
- Lowe, D. (2005) *Networking All-in One Desk Reference for Dummies*. 2nd Ed. Hungry Minds Inc.
- Lowe, D. (2012) *Networking All-in-One For Dummies*. 5th Ed. John Wiley & Sons.
- Olifer, N. and Olifer, V. (2005) *Computer Networks: Principles, Technologies and Protocols for Network Design*. John Wiley and Sons Ltd.
- Reid, A. (2006) *WAN Technologies CCNA 4 Companion Guide*. Cisco Press.
- Spurgeon, C. and Zimmerman, J. (2014) *Ethernet: The Definitive Guide*. 2nd Ed. O'Reilly Media.
- Stallings, W. (2003) *Data and Computer Communications*. 7th International Ed. Upper Saddle River: Prentice Hall.
- Subramanian, M. (2000) *Network Management: An Introduction to Principles and Practice*. Addison-Wesley.
- Subramanian, M. (2000) *Network Management: Principles and Practice*. Harlow: Addison-Wesley.
- Tanenbaum, A. and Wetherall, D. (2013) *Computer Networks*. 5th Ed. Pearson.

### Websites

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|--|--|
| <a href="http://www.ietf.org">www.ietf.org</a>       | Internet Engineering Task Force (General Reference)                |
| <a href="http://www.itu.int">www.itu.int</a>         | International Telecommunication Union (General Reference)          |
| <a href="http://www.iso.org">www.iso.org</a>         | International Organisation for Standardisation (General Reference) |
| <a href="http://www.tmforum.org">www.tmforum.org</a> | TeleManagement Forum (General Reference)                           |
| <a href="http://www.dmtf.org">www.dmtf.org</a>       | Distributed Management Task Force (General Reference)              |

## **Links**

This unit links to the following related units:

*Unit 2: Networking*

*Unit 8: Computer Systems Architecture*

*Unit 15: Transport Network Design*

*Unit 17: Network Security*

*Unit 36: Client/Server Computing Systems*

# **Unit 36: Client/Server Computing Systems**

<b>Unit code</b>	<b>L/615/1680</b>
<b>Unit level</b>	<b>5</b>
<b>Credit value</b>	<b>15</b>

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## **Introduction**

The client/server system is a distributed application structure that partitions tasks or workloads between the providers of a resource or service (called servers) and service requesters (called clients). It is the basis of most internet communication. When surfing the internet, sending/receiving emails, using VoIP software and other applications, these functions work by using client/server systems.

This unit introduces students to the client/server system, an exchange mode for different applications. It consists of communication processes between clients and servers, the operation of applications based on the client/server system, and the socket programming used to code the system.

Among the topics included in this unit are: an introduction to the internet (concept, history, operation), client/server systems, various application protocols based on client/server systems, an introduction to Linux, client/server system programming, security considerations.

On successful completion of this unit students will be able to demonstrate an understanding of the concepts of servers, clients, and processes; illustrate different application protocols based on a client/server model (such as the meaning of http in a website address, POP/IMAP in email); reconstruct a client/server model in Linux systems.

As a result they will develop skills such as communication literacy, critical thinking, analysis, reasoning and interpretation, which are crucial for gaining employment and developing academic competences.

## **Learning Outcomes**

By the end of this unit students will be able to:

- LO1. Explore the concepts of servers, clients, and processes and the differences between PPID and PID.
- LO2. Analyse the communication processes between clients and servers in different application protocols with records captured from the internet.
- LO3. Create a client/server model in a Linux system with User Datagram Protocol (UDP), Transmission Control Protocol (TCP) and Application Layer protocols.

## Essential Content

### **L01 Explore the concepts of servers, clients, and processes and the differences between PPID and PID**

Introduction to the structure of Open Systems Interconnection model (OSI model) and the operation of Transmission Control Protocol/Internet Protocol (TCP/IP).

Basic concepts of client, server, process.

Introduction to the concept and function of Sockets Interface.

The communication process between servers and clients (e.g. echo server process).

Measures to ensure server security.

### **L02 Analyse the communication processes between clients and servers in different application protocols with records captured from the internet**

Typical internet applications.

The concept, function, communication process based on the client/server system, and applications of following protocols:

Domain Name System (DNS).

Dynamic Host Configuration Protocol (DHCP).

Remote Interactive Computing: TELNET/ Secure Shell (SSH).

Email: Simple Mail Transfer Protocol (SMTP)/ Post Office Protocol (POP)/Internet Message Access Protocol (IMAP)/ Multipurpose Internet Mail Extensions (MIME).

File Transfer and Access: File Transfer Protocol (FTP)/ Trivial File Transfer Protocol (TFTP)/ Network File System (NFS).

World Wide Web: Hypertext Transfer Protocol (HTTP).

Network Management: Simple Network Management Protocol (SNMP).

*Introduction to the Wireshark:*

Function, history, install Wireshark, interface, and operation.

### **L03 Create a client/server model in a Linux system with User Datagram Protocol (UDP), Transmission Control Protocol (TCP) and Application Layer protocols**

*Introduction of Linux:*

Introduction to the Linux system: concept, history, advantages and disadvantages.

Basics–Linux command, the way to compile, the debugging method.

*Programming of client/server program:*

Socket Programming in Linux, including socket operation, byte order operation, address formats conversion, socket option, name and address operation, secure coding.

Simple UDP client / server program: UDP-based socket API, UDP-based client, UDP-based server.

Simple TCP client / server program: TCP-based socket API, TCP-based client, TCP-based server.

Application programming, such as a DNS server/client system.

## Learning Outcomes and Assessment Criteria

Pass		Merit	Distinction
<b>LO1</b> Explore the concepts of servers, clients, and processes and the differences between PPID and PID			<b>LO1 &amp; LO2</b> <b>D1</b> Design a realistic model to realise a function in real life using an Application Layer protocol.
<b>P1</b> Illustrate the communication processes between servers and clients.  <b>P2</b> Compare parent process and child process, PID and PPID.	<b>M1</b> Recognise parent process and child process in a communication record (such as the records obtained by Wireshark) between servers and clients.  <b>M2</b> Design a model composed of parent process and child process to realise a simple function.		
<b>LO2</b> Analyse the communication processes between clients and servers in different application protocols with records captured from the internet			
<b>P3</b> Examine the concepts and functions of several Application Layer protocols.  <b>P4</b> Operate Wireshark software, and recognise the different windows in the Wireshark interface.	<b>M3</b> Illustrate the communication processes of Application Layer protocols based on the client/server system.  <b>M4</b> Analyse communication records captured from the internet based on Application Layer protocols.		
<b>LO3</b> Create a client/server model in a Linux system with User Datagram Protocol (UDP), Transmission Control Protocol (TCP) and Application Layer protocols			<b>D2</b> Implement the system with some advanced functions such as breakpoint resume.
<b>P5</b> Create a UDP system in Linux.  <b>P6</b> Create a TCP system in Linux.	<b>M5</b> Build a system with DNS and illustrate it by a flowchart.  <b>M6</b> Implement the created DNS system in Linux.		

## Recommended Resources

### Textbooks

Comer, D. (2013) *Internetworking with TCP/IP Volume I Principles, Protocols and Architecture*. 6th Ed. Pearson.

Comer, D. (2000) *Internetworking with TCP/IP, Vol. III: Client-Server Programming and Applications*. Linux/Posix Sockets Version. 1st Ed. Pearson.

Edwards, J. and Bramante, R. (2009) *Networking Self-Teaching Guide: OSI, TCP/IP, LANs, MANs, WANs, Implementation, Management, and Maintenance*. 1st Ed. Wiley.

Johansen, A. (2015) *LINUX: The Ultimate Beginner's Guide!* CreateSpace Independent Publishing Platform.

### Links

This unit links to the following related units:

*Unit 2: Networking*

*Unit 8: Computer Systems Architecture*

*Unit 15: Transport Network Design*

*Unit 17: Network Security*

*Unit 35: Network Management*

*Unit 49: Operating Systems*



# Unit 37: Architecture

**Unit code** R/615/1681

**Unit level** 5

**Credit value** 15

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## Introduction

The aim of this unit is to provide students with knowledge about computer systems, functionality and organisation. Systems architecture and elements of computing machines will be examined and the principles and fundamentals of how computer systems work. Computer architecture engineers work in industries such as telecoms, automotive and aerospace.

This unit introduces students to the hardware and software architecture of computer systems and low-level language program development using CPU registers to manipulate data. Students will explore how program instructions and data types can be represented, stored in a computer system and used to carry out a computing task.

Among the topics included in this unit are: computer architecture elements, CPU instruction sets, fetch-execute cycle, CPU registers, binary calculations, use of PC and stack, reading/writing to peripherals, architectural security aspects including protected memory segmentation and synchronous/asynchronous channel I/O operations, parallel machines, emerging computer architectures and security considerations.

As a result they will develop skills such as communication literacy, critical thinking, analysis, reasoning and interpretation, which are crucial for gaining employment and developing academic competence.

## Learning Outcomes

By the end of the unit students will be able to:

- LO1. Examine the functions of computer system components.
- LO2. Discuss how data and programs can be represented within computer systems.
- LO3. Demonstrate the principles of processor operations.
- LO4. Investigate advanced computer architectures and performance.

## Essential Content

### **L01 Examine the functions of computer system components**

#### *Component functions:*

Logical/physical component functions; Clock Synchronisation; Processor (CPU), buses, memory maps and IRQ; Boolean logic gates; adder circuits; analysis of how components interact to carry out the fetch-execute cycle and modify data; definition and use of CPU registers. I/O device memory.

### **L02 Discuss how data and programs can be represented within computer systems**

#### *Data/program representation:*

Program/data representation and storage; description, use and storage of data types integer, decimal and character; absolute/relative program location; firmware/software.

### **L03 Demonstrate the principles of processor operations**

#### *Principles of processor operations:*

Low-level program instruction sets; RISC; development of assembler programs (including at least 1 JMP instruction) to manipulate stored data using CPU registers; I/O memory and IRQ locations.

### **L04 Investigate advanced computer architectures and performance**

#### *Advanced Architectures:*

Advanced Architectures; MIMD parallelism (Flynn's Taxonomy), Cache, instruction/graphics pipelining; unconventional architectures; benchmarking; functional unit mix, IRQ latency.

## Learning Outcomes and Assessment Criteria

Pass	Merit	Distinction
<b>LO1</b> Examine the functions of computer system components		<b>D1</b> Illustrate how the processor is physically connected to memory and input/output (I/O) devices using the system buses.
<b>P1</b> Investigate the key computer system components and how they interact.  <b>P2</b> Show how the different types of memory can be attached to a processor.	<b>M1</b> Compare the roles played by different types of memory.	
<b>LO2</b> Discuss how data and programs can be represented within computer systems		<b>D2</b> Investigate how locating a program absolutely in memory can aid ICE target system debugging
<b>P3</b> Investigate, using examples, how different types of data can be converted and stored in computer systems.  <b>P4</b> Carry out Boolean logic operations.	<b>M2</b> Show how, using examples, floating point numbers can be represented in binary form.  <b>M3</b> Illustrate how adder circuits are used to add binary numbers.	
<b>LO3</b> Demonstrate the principles of processor operations		<b>D3</b> Examine how the width of the data bus and address bus affect processor performance and complexity.
<b>P5</b> Illustrate the use of the different processor registers in the fetch execute cycle.  <b>P6</b> Illustrate, with an example, how polling and interrupts are used to allow communication between processor and peripherals.	<b>M4</b> Create a low-level program which includes decision making, branching and I/O operations.  <b>M5</b> Investigate the function of an interrupt handler.	
<b>LO4</b> Investigate advanced computer architectures and performance		<b>D4</b> Critically evaluate, with illustrations, computer performance improvements with MIMD architectures.
<b>P7</b> State the function of DirectX API, describing its advantages and disadvantages.	<b>M6</b> Assess how instruction pipelining modifies the performance of a computer system.  <b>M7</b> Evaluate how the DirectX API is used by application programmers to control graphics functions.	

## Recommended Resources

### Textbooks

Adamatzky, A. (2013) *Collision Based Computing*. Springer.

Blum, R. (2005) *Professional Assembly Language Programming*. John Wiley & Sons.

Gaura, E., Hibbs, D. and Newman, R. (2008) *Computer Systems Architecture*.  
Lexden.

### Links

This unit links to the following related units:

*Unit 8: Computer Systems Architecture*

*Unit 36: Client/Server Computing Systems*

# **Unit 38: Database Management Systems**

**Unit code** Y/615/1682

**Unit level** 5

**Credit value** 15

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## **Introduction**

As globalisation and the 24-hour economy develop and increase, organisations must ensure that their database management systems (DBMS) are reliable, secure, efficient and able to cope with rapid change. Database management systems will continue to service the many operations of our modern world; they are becoming increasingly complex, to develop and manage, due to technological advancements and changes in the way organisations do their business in a global market.

In this unit, students will examine the structure of data, and how an efficient data design follows through into an effectively developed database management system. Students will examine the merits of different DBMS platforms, and investigate system administration and management tools of the platform.

Amongst the topics included in this unit are: examination of different database management systems, database design tools and techniques of relational database management systems, using an open source platform to develop, test and manage a client's system.

On successful completion of this unit students will be able to demonstrate their knowledge of the fundamentals of database management systems, be able to make informed choices between vendor and open source platforms for database management systems, design and develop a relational DBMS for a client using an open source platform, and carry out system administration tasks.

As a result they will develop skills such as communication literacy, critical thinking, analysis, reasoning and interpretation, which are crucial for gaining employment and developing academic competence.

## **Learning Outcomes**

By the end of this unit students will be able to:

- LO1. Analyse different types of database management systems.
- LO2. Design a database management system using a relational model to meet client requirements.
- LO3. Develop a database management system using a suitable platform.
- LO4. Demonstrate the system administration and management tools available on the chosen platform

## Essential Content

### L01 Analyse different types of database management systems

Types of database management systems (DBMS) and their operating system support, e.g. MySQL, Oracle.

Data models: Entity-Relationship, relational, hierarchical, network, object-oriented, object-relational.

Examine details of DBMS based on a relational model.

Relational data structures, including: relations, attributes, domain, tuple, cardinality.

Constraints: key, domain, referential integrity.

Normalisation in developing efficient data structures.

Modelling languages: query language, data definition language (DDL), data, manipulative language (DML), relational languages.

Transaction and concurrency in DBMS.

Investigation of open source and vendor-specific systems.

Multiple platform approaches to database management.

### L02 Design a database management system using a relational model to meet client requirements

Determine user and system requirements.

Examine design tools and techniques for a relational database management system.

Physical system design.

Logical design: design for relational databases, tables, data elements, data types, keys and indexes, entity relationship modelling, data flow diagrams, flowcharts.

Mathematical relations e.g. relational algebra, relational calculus.

DBMS selection, e.g. MySQL.

Application design, including: data entry/input (verification, validation, calculated fields, masks, directed input), reports (queries, presentation of data, layouts), task automation (imports, updates, deletions), queries using multiple criteria, form values and wild cards, action queries, calculated queries, queries across multiple tables.

Hardware, software and other resource requirements.

Test plans to check correctness of data, security, functionality, accessibility and usability.

Quality, effectiveness and appropriateness of the solution: correctness of data, relationships between data, data integrity, normalisation.

Working with clients and others to improve the quality, effectiveness, security and appropriateness of solution design

### **L03 Develop a database management system using a suitable platform**

Use of an appropriate database management system and Structured Query Language (SQL) to produce a secure solution to meet client's requirements.

Creating, setting up and maintaining data tables.

Applying data validation rules.

Generating outputs e.g. user-generated queries, automated queries, reports.

Application and user interface e.g. navigation, data entry forms and sub-forms, automated functions.

Populating the database.

SQL statements to extract, manipulate and modify data.

Applying security measures to control access to data, e.g. user access levels.

Testing the database solution using different types of testing: referential integrity, functionality, security, stability.

Selection and use of appropriate test data.

Selecting suitable test users and gathering feedback from users.

Making use of testing outcomes to improve and/or refine the solution.

Reviewing the solution, criteria for use when reviewing the solution against: quality of the database, fitness for purpose, suitability against the original requirements, technology constraints, strengths and improvements, platforms and compatibility.

Optimising the solution: data types, data sizes e.g. size on disk, many tables e.g. overheads for many tables, query optimising.

### **L04 Demonstrate the system administration and management tools available on the chosen platform**

Describe core database administration tasks and tools.

*Practical demonstrations of server management to include:*

Setting up and managing data storage for servers and users.

Backup and recovery routines for data and applications.

Managing authorisations.

Managing security and encryption.

Importing and exporting data.

Trace database activity.

Monitoring performance and optimising performance.

Audit trails.

Managing alerts and notifications.

Database maintenance including setting up automatic routines.

## Learning Outcomes and Assessment Criteria

Pass		Merit	Distinction
<b>LO1</b> Analyse different types of database management systems			<b>D1</b> Critically evaluate different database management systems available in relation to open source and vendor-specific platforms, justifying the criteria used in the evaluation.
<b>P1</b> Compare and contrast the different types of database models.	<b>M1</b> Assess how relational database models and the process of normalisation can provide reliable and efficient data structures.		
<b>LO2</b> Design a database management system using a relational model to meet client requirements			<b>LO2 &amp; LO3</b> <b>D2</b> Critically evaluate the effectiveness of the system design and development against client and system requirements.
<b>P2</b> Produce a design for a relational database management system to meet client requirements.	<b>M2</b> Analyse how the design will optimise system performance.		
<b>LO3</b> Develop a database management system using a suitable platform			
<b>P3</b> Develop a fully functional system which meets client and system requirements, using an open source language (with an application software e.g. MySQL with front end Microsoft Access). <b>P4</b> Test the system for functionality and performance.	<b>M3</b> Implement effective features in the solution to handle concurrency, security, user authorisations and data recovery.		



Pass	Merit	Distinction
<b>L04</b> Demonstrate the system administration and management tools available on the chosen platform		<b>D3</b> Assess any future improvements that may be required to ensure the continued effectiveness of the database system.
<b>P5</b> Demonstrate the tools available in the system to monitor and optimise system performance, and examine the audit logs.  <b>P6</b> Demonstrate the tools available in the system to manage security and authorisations.	<b>M4</b> Assess the effectiveness of the system administration and management tools available on the platform identifying any shortcomings of the tools.	

## Recommended Resources

### Textbooks

Connolly, T. and Begg, C. (2014) *Database systems: A practical guide to design, implementation and management*. 3rd Ed. Addison-Wesley.

Elmasri, R. and Navathe, S. (2011) *Fundamentals of Database Systems*. 6th Ed. Addison-Wesley.

Hoffer, J. (2008) *Modern Database Management*. Pearson Education.

Jeffrey A., Ramesh, V. and Topi Heikki, T. (2012) *Modern Database Management*. Pearson Education.

Silberschatz, A., Korth, H.F. and Sudarshan, S. (2011) *Database System Concepts*. 6th Ed. McGraw-Hill Edition.

Plus others linked specifically to the version of the software used for a given platform.

### Journals

*International Journal of Database Management Systems*

*Journal of Database Management*

*The Computer Journal*

*Journal of Emerging Trends in Computing and Information Sciences*

### Links

This unit links to the following related units:

*Unit 4: Database Design & Development*

*Unit 7: Strategic Information Systems*

# **Unit 39: E-Commerce & Strategy**

**Unit code** D/615/1683

**Unit level** 5

**Credit value** 15

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## **Introduction**

Electronic Commerce, or E-Commerce, refers to any type of commercial/business transaction where information, data, products and services are exchanged across the internet. These transactions can cover a wide diversity of business types to include: consumer-based retail sites (e.g. Amazon), sites that provide facilities such as auctions (e.g. eBay) and business exchanges between different organisations. E-Commerce allows consumers to electronically exchange goods and services 24/7 with no barriers in terms of time or geography.

Within this unit students will gain an understanding of how and why businesses and organisations develop E-Commerce strategies: to remain competitive in the global market. Students will also appreciate the elements and resources required to set up an E-Commerce site and be engaged in the design and implementation of their own strategies that would in reality form part of a secure E-Commerce site.

Students will examine the impact that E-Commerce has on society and the global market for consumers, buyers and sellers in terms of the benefits and drawbacks of online purchasing. Through investigation, students will also research the technologies involved in setting up a secure E-Commerce site in preparation for their own E-Commerce strategy.

There is an expectation that students will devise a strategy based on an element of E-Commerce such as designing a shopping cart, an ordering system, payment system or an online marketing system, for example. This design should be fully implemented and evaluated accordingly in terms of its success or failure.

Standards and levels of support, marketing, CRM, promotion and supply chain management will all be explored within the context of developing the implementation strategy.

On successful completion of this unit a student will have gained both a technical and practical insight into E-Commerce strategy, design and development. As a result they will develop skills such as communication literacy, critical thinking, analysis, reasoning and interpretation, which are crucial for gaining employment and developing academic competence.

## Learning Outcomes

By the end of this unit students will be able to:

- LO1. Examine the strategies employed and the impact of E-Commerce on business organisations.
- LO2. Analyse the hardware, software, web-based and database technologies involved in setting up a secure E-Commerce site.
- LO3. Design an E-Commerce strategy based on a given end user requirement or specification.
- LO4. Implement an E-Commerce strategy based on a given end user requirement or specification.

## Essential Content

### **L01 Examine the strategies employed and the impact of E-Commerce on business organisations**

#### *Customer expectations:*

Raised expectations for a quick and efficient service e.g. timely responses to customer communications, quick delivery of the product or service, accurate information, reduced pricing for the product/service, greater choice.

#### *Benefits:*

Wider market, niche target marketing, lower overheads and costs, greater flexibility and access to goods/services 27/7.

#### *Drawbacks:*

Visibility, security issues and threats, down-time, high set up and maintenance costs, need to employ a technician or web-based administrator to manage the provision.

### **L02 Analyse the hardware, software, web-based and database technologies involved in setting up a secure E-Commerce site**

#### *Web architecture:*

Components e.g. server-side scripting, client/server/script interaction, operation of server-side web applications, accessing data on the web server, dynamic web pages, consistent navigational menu on all pages, browser cookies, embedding animation and video content in web pages, adding interactivity with plug-ins.

#### *Hardware and software:*

Web servers, browsers, server software, web authoring tools, database system, shopping cart software, scripting software, browser and platform compatibility. Networking technology e.g. TCP/IP addresses, ports and protocols; domain names, multiple registration of domains (.com as well as .co.uk); setting up the server directory structure, deploying access configuration/security.

#### *Database technology:*

Uses and processes e.g. database-driven web pages, opening a connection to a database, storing data captured from forms, performing dynamic queries on the database, generating a web page response displaying the results of a query.

*Communication technology:*

Uses e.g. email support, forum; search engine optimisation; additional hardware and software components required to support communications.

*Data transmission:*

Features e.g. download speeds, transfer rates, bandwidth required for given applications including text, graphics, video, speech.

**L03 Design an E-Commerce strategy based on a given end user requirement or specification**

*Considerations:*

Hardware and software, design and development, costs and resources, security, maintenance, customer online support and logistics.

*Internet strategy:*

Hosting e.g. internal, sub-contracted; design of the website; maintaining 24/7 access.

*Marketing strategy:*

Methods e.g. targeting market segments and interest groups, developing electronic 'web-communities', CRM, promotion strategies to target specific market segments, search engine optimisation, e-marketing software.

*Supply chain strategy:*

Methods e.g. satisfying customer demand, responsive supply chain, managed in house or sub-contracted, developing 'partnership' relationships with suppliers.

*Electronic payment:*

Methods e.g. online transaction processing, Commercial Off the Shelf Software (COTS), other payment systems e.g. PayPal, WorldPay.

**L04 Implement an E-Commerce strategy based on a given end user requirement or specification**

*Implementation:*

Demonstrate that the E-Commerce strategy devised has been implemented using suitable tools and applications. The strategy could be marketing, supply chain or payment based, for example designing an online ordering system or an online payment system.

*Evaluation:*

Evaluate the success of the design and implementation of the E-Commerce strategy.

*Technique:*

SWOT analysis to evaluate the overall strengths, weaknesses, opportunities and threats of the implemented E-Commerce strategy.

## Learning Outcomes and Assessment Criteria

Pass		Merit	Distinction
<b>LO1</b> Examine the strategies employed and the impact of E-Commerce on business organisations			<b>D1</b> Critically review the benefits and drawbacks of an organisation utilising E-Commerce.
<b>P1</b> Discuss the importance of addressing and meeting customer expectations when employing an E-Commerce strategy.	<b>M1</b> Analyse organisation case studies and examine how E-Commerce has been used to improve an element of business operations.		
<b>LO2</b> Analyse the hardware, software, web-based and database technologies involved in setting up a secure E-Commerce site			<b>D2</b> Evaluate the role that database technology plays in the development and sustainability of E-Commerce.
<b>P2</b> Discuss the technologies involved in setting up a secure E-Commerce site.	<b>M2</b> Justify the importance of communications technology in E-Commerce design.		
<b>LO3</b> Design an E-Commerce strategy based on a given end user requirement or specification			<b>D3</b> Appraise the design and functionality of the E-Commerce solution.
<b>P3</b> Discuss the types of strategies that could be used to drive an E-Commerce solution. <b>P4</b> Design an E-Commerce solution based on a specified requirement or strategy.	<b>M3</b> Analyse the factors and resources that should be considered when designing an E-Commerce strategy. <b>M4</b> Differentiate between the types of payment systems that are integral to E-Commerce success.		
<b>LO4</b> Implement an E-Commerce strategy based on a given end user requirement or specification			<b>D4</b> Evaluate the success of the E-Commerce implementation and identify how it fulfils a specified requirement or strategy.
<b>P5</b> Implement an E-Commerce solution based on a specified requirement or strategy.	<b>M5</b> Produce a detailed SWOT analysis to support the implemented E-Commerce design.		



## Recommended Resources

### Textbooks

Bones, C. and Hammersley, J. (2015) *Leading Digital Strategy: Driving Business Growth Through Effective E-commerce*. 1st Ed. Kogan Page.

Chaffey, D. (2009) *E-Business and E-Commerce Management: Strategy, Implementation and Practice*. 4th Ed. Financial Times: Prentice Hall.

Laudon, K. and Traver, C. (2015) *E-Commerce*. 11th Ed. Pearson.

Phillips, J. (2016) *Ecommerce Analytics: Analyse and Improve the Impact of Your Digital Strategy*. 1st Ed. Pearson FT Press.

### Journals

*Journal of Electronic Commerce Research*

*Journal of Electronic Commerce in Organisations (JECO)*

### Websites

www.networksolutions.com	Network Solutions Education Centre "Developing an E-Commerce Strategy" (Articles)
www.ecommercefuel.com	E-Commerce Fuel (Discussion Forum)

### Links

This unit links to the following related units:

*Unit 4: Database Design & Development*

*Unit 14: Business Intelligence Systems*

*Unit 38: Database Management Systems*

# **Unit 40: User Experience and Interface Design**

<b>Unit code</b>	<b>H/615/1684</b>
<b>Unit level</b>	<b>5</b>
<b>Credit value</b>	<b>15</b>

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## **Introduction**

User Experience (UX) and User Interface (UI) Design is the process by which software applications and user interactions can be designed to be simple, accessible, effective and attractive for the end user. The objective of UX and UI Design is to create user interactions and software application experiences that are appropriate for specific platforms or devices and provide desirable end user outcomes utilising insight and understanding about the practical, emotional and experiential motivations and values of the end user. UX and UI Design explores the motivations and desires of the end user and seeks to design user's interactions that best satisfy those motivations and desires in a concise manner.

This unit introduces students to the role, basic concepts and benefits of UX and UI Design in the development process of software applications. The aim of the unit is to enhance the student's understanding of the methodology, terminology and benefits of UX and UI Design in the development of software applications.

Among the topics included in this unit are: classification and terminology of UX and UI Design techniques, the relationship between UX and UI Design, how UX and UI Design relates to the rest of the software development lifecycle, understand a user's emotions, desires and attitudes about using a particular feature, product, system, platform or software application, modes of interaction, human-computer interaction models, usability, accessibility, aesthetics, design thinking, value proposition design, user journey mapping and gathering meaningful insights from users feedback and research.

On successful completion of this unit students will be able to explain the basic concepts of UX and UI Design. Plan, build and measure the success of an appropriate UI Design. Design an interface and experience with a specific end user in mind. Conduct testing to gather meaningful feedback to evaluate the success or failure of a user interface. As a result they will develop skills such as communication literacy, design thinking, team working, critical thinking, analysis, reasoning and interpretation, computer software literacy which are crucial for gaining employment and developing academic competence.

## Learning Outcomes

By the end of this unit students will be able to:

- LO1. Research what aspects of User Experience and Interface Design are necessary and appropriate to satisfy end user emotions, desires and attitudes when using a user interface concept.
- LO2. Plan an appropriate User Experience map and Interface Design for a User Interface concept with a specific target end user in mind and also outline the tests you mean to conduct.
- LO3. Build a User Interface concept and test it with users to see if it satisfies their emotions, desires and attitudes as planned.
- LO4. Evaluate user feedback, test results and insights gained from end users interacting with your User Interface concept to determine success or failure and steps to improve in future versions.

## Essential Content

### **L01 Research what aspects of User Experience and Interface Design are necessary and appropriate to satisfy end user emotions, desires and attitudes when using a user interface concept**

*Identify formats, characteristics and appropriateness of UX and UI Design*

Present an overview of UX and UI Design, how they are produced and their appropriate use in software development.

Identify what UX and UI Design is by researching the role, purpose, terminology and methodology of UX and UI Design.

Recognise the various forms of UX and UI Design by researching the history of, current trends and use in the product development lifecycle.

Recognise the use of appropriate UX and UI Design patterns.

Define the characteristics of UX and UI Designs by investigating how they can be used to satisfy end user emotions, desires and attitudes.

*Recognise specific forms, patterns and trends of UX and UI Design:*

Research, debate and agree current functionality, patterns and trends in UX and UI Design.

Identify various forms of UX and UI Design.

Define the advantages and disadvantages of using UX and UI Design.

*Define standard tools available for use in UX and UI Design:*

Identify standard tools available to create UX and UI Designs.

The advantages and disadvantages of UX and UI Design tools.

How UX and UI Design tools can be used to capture end user feedback.

Appropriateness of various tools for different end user testing outcomes.

### **L02 Plan an appropriate User Experience map and Interface Design for a User Interface concept with a specific target end user in mind and also outline the tests you mean to conduct**

*Identify a specific end user and an appropriate UX and UI Design to test with this user type:*

Choose a specific end user to conduct tests against.

Evaluate the benefits, features, advantages and disadvantages of different UX and UI Design methodologies for various end user testing outcomes.

Review different end user categorisations, classifications and behaviour modelling techniques.

Select the most appropriate form of UX and UI Design to achieve desired end user testing and outcomes.

*Describe a plan to use appropriate UX and UI Design methodology and tools to conduct end user testing:*

Apply end user classification and behaviour modelling to select an appropriate UX and UI Design methodology.

Outline the end user characteristics, desired testing criteria and results your UX and UI Design addresses.

Select an appropriate form of UX and UI Design necessary to achieve desired results.

Use your selected end user, appropriate UX and UI Design methodology and desired testing criteria to create a plan for a UI concept.

**L03 Build a User Interface concept and test it with users to see if it satisfies their emotions, desires and attitudes as planned**

*Utilise appropriate tools to develop a UX and UI Design:*

Employ an appropriate set of tools to develop your plan into a UI.

Run end user experiments and examine feedback.

Reconcile and evaluate end user feedback and build a new iteration of your user interface modified with the most important feedback and enhancements.

Make multiple iterations of your user interface and modify each iteration with enhancements gathered from user feedback and experimentation.

**L04 Evaluate user feedback, test results and insights gained from end users interacting with your User Interface concept to determine success or failure and steps to improve in future versions**

*Asses the success of your UX and UI Design:*

Assemble and appraise end use feedback from multiple iterations of your user interface.

Undertake a critical review and compare your final user interface and your test results with the original plan.

Evaluate the advantages, disadvantages, strengths and weaknesses of your UX and UI Design methodology.

Critique the overall success of your UI and discuss your UX insights.

## Learning Outcomes and Assessment Criteria

Pass		Merit	Distinction
<b>LO1</b> Research what aspects of User Experience and Interface Design are necessary and appropriate to satisfy end user emotions, desires and attitudes when using a user interface concept			
<b>P1</b> Recognise specific forms of User Experience and Interface Design and end user testing requirements.  <b>P2</b> Assess standard tools available for use in User Experience and Interface Design.	<b>M1</b> Evaluate the impact of common User Experience and Interface Design methodology in the software development life cycle.  <b>M2</b> Review specific forms of User Experience and Interface Design and advantages and disadvantages of end user testing requirements for appropriateness to different testing outcomes.	<b>D1</b> Evaluate specific forms of User Experience and Interface Design and justify their use in a User Interface concept.	
<b>LO2</b> Plan an appropriate User Experience map and Interface Design for a User Interface concept with a specific target end user in mind and also outline the tests you mean to conduct			
<b>P3</b> Review different end user categorisations, classifications and behaviour modelling techniques.  <b>P4</b> Appraise a specific end user and an appropriate User Experience and Interface Design methodology to test with this user type.	<b>M3</b> Apply end user classification and behaviour modelling to select an appropriate Interface Design methodology.  <b>M4</b> Devise a plan to use appropriate User Interface Design methodology and tools to conduct end user testing.	<b>LO2 &amp; LO3</b>  <b>D2</b> Make multiple iterations of your User Interface concept and modify each iteration with enhancements gathered from user feedback and experimentation.	

Pass		Merit	Distinction
<b>LO3</b> Build a User Interface concept and test it with users to see if it satisfies their emotions, desires and attitudes as planned			
<b>P5</b> Examine appropriate tools to develop a user interface.  <b>P6</b> Run end user experiments and examine feedback.	<b>M5</b> Employ an appropriate set of tools to develop your plan into a user interface.  <b>M6</b> Reconcile and evaluate end user feedback and build a new iteration of your user interface modified with the most important feedback and enhancements.		
<b>LO4</b> Evaluate user feedback, test results and insights gained from end users interacting with your User Interface concept to determine success or failure and steps to improve in future versions			
<b>P7</b> Evaluate end use feedback from multiple iterations of your user interface.	<b>M7</b> Undertake a critical review and compare your final user interface and your test results with the original plan.	<b>D3</b> Critique the overall success of your User Interface concept and discusses your insight using prototyping.	

## Recommended Resources

### Textbooks

Hanington, B. (2013) *Universal Methods of Design: 100 Ways to Research Complex Problems, Develop Innovative Ideas, and Design Effective Solutions*. Rockport Publishers.

Kalbach, J. (2015) *Mapping Experiences: A Complete Guide to Creating Value through Journeys, Blueprints, and Diagrams*. 1st Ed. O'Reilly Media.

Lidwell, W. (2010) *Universal Principles of Design, Revised and Updated: 125 Ways to Enhance Usability, Influence Perception, Increase Appeal, Make Better Design Decisions, and Teach through Design*. 2nd Ed. Rockport Publishers.

Tidwell, J. (2011) *Designing Interfaces*. 2nd Ed. O'Reilly Media.

### Links

This unit links to the following related units:

*Unit 10: Website Design & Development*

*Unit 28: Prototyping*



# **Unit 41:                      Analytic Architecture Design**

**Unit code**                      **T/615/1687**

**Unit level**                      **5**

**Credit value**                      **15**

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## **Introduction**

Aircraft, trains and other high-tech machines improve our quality of life – none of these could function without automatic systems. The ability to analyse and design an automatic system is a vital subject. Architecture Analysis & Design Language (AADL) is designed for the specification, analysis, automated integration and code generation of real-time performance-critical (timing, safety, schedulability, fault tolerant, security, etc.) distributed computer systems.

This unit introduces students to the AADL. It provides an introduction to the language and AADL specifications, which is defined in the Society of Automotive Engineers (SAE) standard. The SAE AADL standard provides formal modelling concepts for the description and analysis of application systems architecture in terms of distinct components and their interactions. Within the AADL, a component is characterised by its identity, possible interfaces with other components, distinguishing properties, subcomponents and their interactions. The AADL is a useful tool to model and analyse the existing systems, but also design and integrate new systems.

Among the topics included in this unit are: AADL overview, system models and specification, security, components (software components, execution platform components), structure and instantiation, mode and flow, and properties.

On successful completion of this unit students will be able to describe the abstractions that support the specification of component interactions; present the specification of alternative operational states of a system; describe the use of the AADL flows concept and present examples of the specification of abstract flows throughout a system; describe the constructs for organising an AADL specification. It includes examples of AADL architectural pattern sets.

As a result, they will develop skills such as communication literacy, critical thinking, analysis, reasoning and interpretation, which are crucial for gaining employment and developing academic competence.

## **Learning Outcomes**

By the end of this unit students will be able to:

- LO1. Explore detailed and problem-oriented material and gain a conceptual overview of the AADL abstractions.
- LO2. Illustrate the software component and execution platform component abstractions, and provide example declarations for these components.

- LO3. Analyse the specification of composite systems and their instances, and describe the abstractions that support the specification of component interactions.
- LO4. Show the specification of alternative operational states of a system by AADL flow concepts, and describe modes mode transitions, and examples of specification.

## Essential Content

### **L01 Explore detailed and problem-oriented material and gain a conceptual overview of the AADL abstractions**

*AADL overview (concept, history, applications).*

*Abstractions:*

Basic component of AADL, utilisation of AADL.

*System models and specification:*

Introduction to architectural analysis and AADL architecture.

### **L02 Illustrate the software component and execution platform component abstractions, and provide example declarations for these components**

*Software components:*

Introduction to the AADL software component, the way to describe data, subprogram and thread, different representations of software component.

*Execution platform component:*

Introduction to the AADL hardware component, the way to describe Processor, Memory, Bus and Device, different representations of software component.

### **L03 Analyse the specification of composite systems and their instances, and describe the abstractions that support the specification of component interactions**

*System abstraction:*

Textual and graphical representations of system.

*System instance:*

The way to create system instance and implementation.

*Component interactions:*

Introduction to the connection between interface elements, implement the port and the access in the system design.

*Subcomponent:*

Introduction to implementation of the subcomponents in system, and the access of data in difference subcomponents.

*Software components:*

Implementation of software components in system design.

*Execution platform components:*

Implementation of execution platform components in system design.

**L04 Show the specification of alternative operational states of a system by AADL flow concepts, and describe modes mode transitions, and examples of specification**

Modes and Flow; Properties; Structure and Instantiation.

*Model specifications:*

Basic introduction to the modes and the representations of modes.

*Model configurations:*

Thread with control system, modes in calls sequences.

*Flow declarations:*

Introduction basic flow concept and element.

*Flow paths:*

Flow paths of different components in flow design, including secure features.

*Property declarations:*

Idea of property and declarations about the property.

System abstraction.

## Learning Outcomes and Assessment Criteria

Pass		Merit	Distinction
<b>LO1</b> Explore detailed and problem-oriented material and gain a conceptual overview of the AADL abstractions			<b>LO1 &amp; LO2</b>  <b>D1</b> Critically analyse components, physical design and logical elements.
<b>P1</b> Interpret the basic concept of elements and the methods of AADL, and analyse an example using AADL.  <b>P2</b> List the advantages and disadvantages of using AADL.	<b>M1</b> Design and build a system using AADL to realise a specific function.  <b>M2</b> Distinguish the different AADL representations.		
<b>LO2</b> Illustrate the software component and execution platform component abstractions, and provide example declarations for these components			
<b>P3</b> Present a software component using different representations.  <b>P4</b> Distinguish the software components and execution platform components in a system.	<b>M3</b> Declare components under AADL specification.  <b>M4</b> Implement different components in a system.		
<b>LO3</b> Analyse the specification of composite systems and their instances, and describe the abstractions that support the specification of component interactions			<b>LO3 &amp; 4</b>  <b>D2</b> Analyse a whole system, and present its logic design and physical design.
<b>P5</b> Design a system that consists of various types of elements.  <b>P6</b> Discuss the advantages and weak points of the system designed in P5.	<b>M5</b> Present the design logic and the relationships between components in the design process.  <b>M6</b> Illustrate data interaction processes between components and analyse the data communication in the whole system.		

Pass	Merit	Distinction
<p><b>LO4</b> Show the specification of alternative operational states of a system by AADL flow concepts, and describe modes mode transitions, and examples of specification</p>		
<p><b>P7</b> Design system in flow and modes format.</p> <p><b>P8</b> Recognise different flows and identify the operating process.</p>	<p><b>M7</b> Provide relevant information in design process of flow, such as basic ideas, selection of elements.</p> <p><b>M8</b> Present the contracture of organising an AADL specification.</p>	

## Recommended Resources

### Textbooks

Feiler, P., Lewis, B., Vestal, S. and Colbert, E. (2005) *An Overview of the SAE Architecture Analysis & Design Language (AADL) Standard: A Basis for Model-Based Architecture-Driven Embedded Systems Engineering*. 1st Ed. Springer.

Gluch, D. and Feiler, P. (2012) *Model-Based Engineering with AADL: An Introduction to the SAE Architecture Analysis & Design Language*. 1st Ed. Addison-Wesley Professional.

Kordon, F., Hugues, J., Canals, A. and Dohet, A. (2013) *Embedded Systems: Analysis and Modeling with SysML, UML and AADL*. 1st Ed. Wiley-ISTE.

### Links

This unit links to the following related units:

*Unit 20: Advanced Programming*

# **Unit 42: Risk Analysis & Systems Testing**

**Unit code** F/615/1689

**Unit level** 5

**Credit value** 15

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## **Introduction**

Risk-based testing prioritises tests during the system testing phase based on the highest impact and probability of system failure.

The aim of this unit is to provide students with knowledge and skills to use risk-based testing (RBT) using a medium-sized application, developing a full and detailed RBT procedure and documenting the results. They will then be able to evaluate the effectiveness of the application and the testing procedures employed. RBT is used widely in industry to organise software testing and use test resources more efficiently.

This unit introduces students to prioritising testing software features according to risk of failure, evaluated as a function of criticality or importance and impact of failure. Risk of software failure determines the priority of tests within a Test Plan, strategically carrying out testing over multiple test cycles.

Among the topics included in this unit are: how to classify and evaluate software risks using the risk formula, risk matrix, RBT testing and test build strategies, priority test cycles, security testing, coverage analysis and risk reduction reports.

As a result they will develop skills such as communication literacy, critical thinking, analysis, reasoning and interpretation, which are crucial for gaining employment and developing academic competence.

## **Learning Outcomes**

By the end of this unit students will be able to:

- LO1. Examine risk-based testing and requirements.
- LO2. Create a customised risk-based test strategy, plans and techniques for a given specification.
- LO3. Demonstrate a risk-based Test Plan, producing associated outcomes.
- LO4. Evaluate a risk-based Test Plan and its associated outcomes.



## Essential Content

### L01 Examine risk-based testing and requirements

*Risk-based testing and requirements:*

Stages: evaluate risk-based testing stage model (ISO/IEC 9126-1); define no risk/no test; distinguish risk classifications, business/operational, security, technical, external; apply risk formula  $r(f) = P(f) * C(f)$ ; test risk assessment/criticality; develop risk weighted matrix; develop risk quality matrix; assess risk reduction methods; detail project risks; identify methods of reporting progress.

### L02 Create a customised risk-based test strategy, plans and techniques for a given specification

*Risk-based test strategy, plan and techniques:*

Test strategy: develop test risk matrix, selection of risk-based tests; develop risk test plan; build environment rollout plan development; implementation (black box or functional testing, white (or glass) box testing; sub-system, integration (use-case, whole system, interface); maintenance (following changes or reviews, after length of time, stress/overload); user evaluation (analysis of requirements, actual outcomes, acceptance, alpha, beta).

Test Plan: examine test cycles (prioritising security testing); example test data (normal, erroneous, extreme), define expected outcomes (valid, invalid, information gained), reporting of risk.

Techniques: apply black box or functional testing (e.g. control flow, data flow), white (or glass) box testing (e.g. boundary value, branch condition); validation, verification; analyse test coverage/follow up; fault density analysis.

### L03 Demonstrate a risk-based Test Plan, producing associated outcomes

*Outcomes:*

Review code coverage results and analysis; analyse cause defects; check fault density results; review actual results against expected results (valid information or action, invalid information or action; system-generated messages, program-generated messages).

*Modifications:*

Prioritisation of further test cycles; changes to specification, changes to analysis, design, amendments to code written, modifications to risk test strategy and plan; create risk reduction reports.

#### **L04 Evaluate a risk-based Test Plan and its associated outcomes**

##### *Evaluation:*

Develop risk heuristics evaluation criteria (probability, severity, classification); identify risk-based testing benefits/drawbacks; define fit for purpose criteria; functionality, accuracy, security effectiveness; alterations to tests carried out, possible improvements; program specification and design, self-reflection, management aspects.

##### *Maintainability:*

Perform risk testing and reporting refinement; usefulness to self, usefulness to others.

## Learning Outcomes and Assessment Criteria

Pass		Merit	Distinction
<b>LO1</b> Examine risk-based testing and requirements			<b>LO1 &amp; LO2</b> <b>D1</b> Justify selection of test cases based on quantified risk to project.
<b>P1</b> Investigate the testing stages involved in relation to a risk-based testing model.  <b>P2</b> Discuss the type of risks involved in systems testing in relation to the given specification.	<b>M1</b> Determine three benefits in applying risk-based testing.  <b>M2</b> Present key information to be communicated post-risk-based testing.		
<b>LO2</b> Create a customised risk-based test strategy, plans and techniques for a given specification			
<b>P3</b> Establish a risk-based test strategy for the given specification, explaining specifically how security testing will be carried out.  <b>P4</b> Develop a full and detailed Test Plan relating to the risk-based test strategy.	<b>M3</b> Create a test risk matrix showing how the risks were evaluated.  <b>M4</b> Design and apply a suitable risk-based test cycle.		
<b>LO3</b> Demonstrate a risk-based Test Plan, producing associated outcomes			<b>D2</b> Assess the importance of a suitable build environment to support a risk-based test strategy.
<b>P5</b> Perform the tests identified in the risk-based Test Plan.  <b>P6</b> Provide a detailed log of all test results.	<b>M5</b> Discuss, with the aid of an example, how prioritisation of test cycles can improve testing.  <b>M6</b> Propose a strategy for designing and building a risk-based test environment.		

Pass	Merit	Distinction
<b>LO4</b> Evaluate a risk-based Test Plan and its associated outcomes		<b>D3</b> Examine how test risk heuristics are identified, evaluated and monitored in a risk based test strategy, providing justification.
<b>P7</b> Discuss the reasons for all modifications made at each stage of the risk-based test procedure.  <b>P8</b> Evaluate the effectiveness of the risk based test strategy including an assessment of security testing cycles.	<b>M7</b> Compare two risk-based test strategies and explain the benefits/disadvantages.	

## Recommended Resources

### Textbooks

Demarco, T. and Lister, T. (2003) *Waltzing with Bears: Managing Risk on Software Projects*. Dorset House Publishing.

Nettleton, D. (2006) *Risk-based Software Validation: Ten Easy Steps*. Parenteral Drug Association.

### Journals

Mottahir, M. and Khan, A.I. (2013) *Risk-based Testing Techniques: A Perspective Study*. *International Journal of Computer Applications*. Article.

### Websites

istqbexamcertification.com	International Software Testing Qualifications Board "What is Risk Based testing" (Article)
www.cs.tut.fi	Tampere University of Technology Faculty of Computing and Electrical Engineering "Risk based Testing" (Tutorial)

### Links

This unit links to the following related units:

*Unit 9: Software Development Lifecycles*

# Unit 43: Internet of Things

**Unit code** T/615/1690

**Unit level** 5

**Credit value** 15

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## Introduction

The Internet of Things (IoT) is a network of physical objects – devices, vehicles, drones and other objects embedded with electronics, software, sensors and network connectivity that enables these objects to collect and exchange data. The objective of the IoT is to enable almost any object to become smart, accessible and data capable, thereby benefitting from advances in communications, computation and interconnectivity. IoT explores the mixture of hardware, software, data, platforms and services that can be combined to create innovative opportunities for more direct integration of the physical world and objects into computer-based systems, resulting in improved efficiency, accuracy, social and economic benefit to people.

This unit introduces students to the role, basic concepts and benefits of IoT in the design and development process of computer applications. The aim of the unit is to enhance the student's understanding of the methodology, terminology and benefits of IoT in the design and development of software applications.

Among the topics included in this unit are: classification and terminology of IoT, the hardware, software, data, platforms and services used to enable IoT, common architecture, frameworks, tools, hardware and APIs that can be utilised to design IoT-enabled objects, problems and solutions resulting from widespread deployment and adoption of IoT, software application methodology for IoT specific software application design and development, data models, network complexity, security, privacy, enabling technologies and how to simulate and test an IoT concept.

On successful completion of this unit students will be able to explain the basic concepts of IoT; design, build and simulate an IoT application using any combination of hardware, software, data, platforms and services; be able to discuss the problem IoT applications solves; the potential impact on society, business and the end user and the problems encountered when integrating into the wider IoT ecosystem.

As a result they will develop skills such as communication literacy, design thinking, team working, critical thinking, analysis, reasoning and interpretation, computer software literacy, which are crucial for gaining employment and developing academic competence.

## Learning Outcomes

By the end of this unit students will be able to:

- LO1. Analyse what aspects of IoT are necessary and appropriate when designing software applications.
- LO2. Outline a plan for an appropriate IoT application using common architecture, frameworks, tools, hardware and APIs.

- LO3. Develop an IoT application using any combination of hardware, software, data, platforms and services.
- LO4. Evaluate your IoT application and detail the problem your IoT application solves, the potential impact on people, business, society and the end user and the problems it might encounter when integrating into the wider IoT ecosystem.

## Essential Content

### **L01 Analyse what aspects of IoT are necessary and appropriate when designing software applications**

*Identify role, formats and characteristics of IoT:*

Present an overview of IoT and its appropriate use in software development.

Investigate what IoT is by researching its role, purpose, terminology and methodology.

Recognise the various forms of IoT by researching its history, current trends and use in relation to, and conjunction with, traditional computer-based systems and networks.

Define the characteristics of IoT by investigating how it can be used and how it can interact with existing computer-based networks and the physical world.

Recognise the use of appropriate IoT applications to solve specific problems.

*Research specific forms of IoT functionality:*

Explore various forms of IoT functionality.

Research, debate and agree current functionality, technology and trends for IoT.

Investigate the advantages and disadvantages of using IoT.

*Define standard architecture, frameworks, tools, hardware and APIs available for use in IoT application development:*

Review architecture, frameworks, tools, hardware and APIs available to develop IoT applications.

The advantages and disadvantages of IoT architecture, frameworks, tools, hardware and APIs.

How various architecture, frameworks, tools, hardware and APIs can be used to create IoT applications.

Appropriateness of various architecture, frameworks, tools, hardware and APIs for different problem-solving requirements.

### **L02 Outline a plan for an appropriate IoT application using common architecture, frameworks, tools, hardware and APIs**

*Identify a problem to be solved and select appropriate IoT techniques to solve this problem:*

Choose a specific problem to solve using IoT.

Evaluate the benefits, features, advantages and disadvantages of IoT to solve this problem.

Review different architecture, frameworks, tools, hardware and API techniques you could apply to solve this problem.



Select the most appropriate IoT architecture, frameworks, tools, hardware and API techniques to include in an application to solve this problem.

*Describe a plan for an IoT application to solve this problem:*

Outline the problem you intend to solve and how IoT and your application addresses this problem.

Select an appropriate IoT application to achieve desired results.

Apply IoT architecture, frameworks, tools, hardware and API techniques to solve this problem.

Use your selected techniques to create an IoT application development plan.

**L03 Develop an IoT application using any combination of hardware, software, data, platforms and services**

*Utilise appropriate tools and techniques to develop an IoT application:*

Employ an appropriate set of tools to develop your plan into an IoT application.

Run end user experiments and examine feedback.

Reconcile and evaluate end user feedback and determine advantages and disadvantages of your chosen IoT techniques.

**L04 Evaluate your IoT application and detail the problem your IoT application solves, the potential impact on people, business, society and the end user and the problems it might encounter when integrating into the wider IoT ecosystem**

*Assess the success of your IoT application:*

Assemble and appraise end use feedback from your IoT application.

Undertake a critical review and compare your final application with the original plan.

Evaluate the advantages, disadvantages, strengths and weaknesses of your IoT techniques.

Critique the overall success of your application. Did it solve your problem? What is the potential impact on people, business, society and the end user? What problems might it encounter when integrating into the wider IoT ecosystem?

Discusses your insight using IoT.

## Learning Outcomes and Assessment Criteria

Pass		Merit	Distinction
<b>LO1</b> Analyse what aspects of IoT are necessary and appropriate when designing software applications			<b>D1</b> Evaluate specific forms of IoT architecture and justify their use when designing software applications.
<b>P1</b> Explore various forms of IoT functionality.  <b>P2</b> Review standard architecture, frameworks, tools, hardware and APIs available for use in IoT development.	<b>M1</b> Evaluate the impact of common IoT architecture, frameworks, tools, hardware and APIs in the software development life cycle.  <b>M2</b> Review specific forms of IoT architecture, frameworks, tools, hardware and APIs for different problem-solving requirements.		
<b>LO2</b> Outline a plan for an appropriate IoT application using common architecture, frameworks, tools, hardware and APIs			<b>LO2 &amp; LO3</b>  <b>D2</b> Make multiple iterations of your IoT application and modify each iteration with enhancements gathered from user feedback and experimentation.
<b>P3</b> Investigate architecture, frameworks, tools, hardware and API techniques available to develop IoT applications.  <b>P4</b> Determine a specific problem to solve using IoT.	<b>M3</b> Select the most appropriate IoT architecture, frameworks, tools, hardware and API techniques to include in an application to solve this problem.  <b>M4</b> Apply your selected techniques to create an IoT application development plan.		
<b>LO3</b> Develop an IoT application using any combination of hardware, software, data, platforms and services.			
<b>P5</b> Employ an appropriate set of tools to develop your plan into an IoT application.  <b>P6</b> Run end user experiments and examine feedback.	<b>M5</b> Reconcile and evaluate end user feedback and determine advantages and disadvantages of your chosen IoT techniques.		

Pass	Merit	Distinction
<p><b>L04</b> Evaluate your IoT application and detail the problem your IoT application solves, the potential impact on people, business, society and the end user and the problems it might encounter when integrating into the wider IoT ecosystem</p>		<p><b>D3</b> Critique the overall success of your application. Did it solve your problem? What is the potential impact on people, business, society and the end user? What problems might it encounter when integrating into the wider IoT ecosystem?</p>
<p><b>P7</b> Evaluate end user feedback from your IoT application.</p>	<p><b>M6</b> Undertake a critical review and compare your final application with the original plan.</p>	

## Recommended Resources

### Textbooks

Arshdeep, B. (2014) *Internet of Things: A Hands on Approach*. 1st Ed. VPT.

McEwen, A. (2013) *Designing the Internet of Things*. 1st Ed. John Wiley and Sons.

### Links

This unit links to the following related units:

*Unit 29: Application Program Interfaces*

*Unit 45: Emerging Technologies*

# Unit 44: Robotics

**Unit code** F/615/1692

**Unit level** 5

**Credit value** 15

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## Introduction

Robots are becoming much more widely used, with applications ranging from agriculture through to manufacturing, including an increasing interest in autonomous systems. These are mechanical devices produced in various forms, including human form. Robots can move by themselves, and their motion can be modelled, planned, sensed, actuated and controlled by programming.

This unit is designed to explore robotic systems, both historically and as an area of rapid contemporary development. The student will be introduced to the different types and applications of robotic systems and will be encouraged to discuss and reflect on the implications of using robots

Topics included in this unit are an introduction to robotic systems, types of robots, industrial robots, automation system components, developing a solution, sensors, and sensor-based robots, ethical considerations, safety, social and economic impacts.

On successful completion of this unit, students will gain experience in building a robot and be exposed to a wide range of practical applications of robotic systems. As a result students will develop skills such as communication literacy, critical thinking, analysis, reasoning and interpretation, which are crucial for gaining employment and developing academic competence.

## Learning Outcomes

By the end of this unit students will be able to:

- LO1. Explore different robotic systems commonly used in industry, taking into account different configurations and the advantages and disadvantages of these.
- LO2. Build a robot and appraise this from the perspectives of cost-benefit impact.
- LO3. Evaluate the operation and application of a range of sensors (e.g. vision, tactile) and how they can apply to a mobile or static robotic system.
- LO4. Evaluate the relevance of biologically inspired robotic systems and how these can benefit both the understanding of biological systems and the design of individual or groups of robots.

## Essential Content

- LO1 Explore different robotic systems commonly used in industry, taking into account different configurations and the advantages and disadvantages of these**

*Introduction to robotics:*

Types and applications of robotics, why robots are important.

*Industrial robotics:*

Applications of robotics to industries, including medical, surgical and rehabilitation robotics.

Advantages and disadvantages, safety, security, social and economic impacts, and ethical issues of robots.

- LO2 Build a robot and appraise this from the perspectives of cost-benefit impact**

*Components and instruction to build:*

Classification of types of robot; identification of manipulator components and terminology; joints classification, compactor, digital millimeter, robot-line followings, battery, register, LEDs, DC motor, etc.

- LO3 Evaluate the operation and application of a range of sensors (e.g. vision, tactile) and how they can apply to a mobile or static robotic system**

*Sensors:*

Range of sensors, their components and compatibilities.

*Tactile sensors:*

Construction of tactile, and touch sensors, interpretation of sensory information, use of sensory data to determine kinematic information.

*Vision systems:*

Computer vision, perception, optical flow, road car and quad-copter navigation.

**L04 Evaluate the relevance of biologically inspired robotic systems and how these can benefit both the understanding of biological systems and the design of individual or groups of robots**

*Biologically inspired robotics:*

Types of biologically inspired robotics, humanoid robots, bio-inspired morphologies, reactive and deliberative control, learning behaviours; multi-robot and swarm systems.

*Reflection:*

How does the robot help to understand biological systems? How do biological systems help to design a robot?

## Learning Outcomes and Assessment Criteria

Pass		Merit	Distinction
<b>LO1</b> Explore different robotic systems commonly used in industry, taking into account different configurations and the advantages and disadvantages of these			<b>LO1 &amp; LO2</b>  <b>D1</b> Critically evaluate the social and ethical impact of using these robots.
<b>P1</b> Analyse the types of robots and their use in industry.  <b>P2</b> Discuss the advantages and disadvantages of using these robots.	<b>M1</b> Choose an industry and critically evaluate the use of robotics in that industry and the benefits of using them.		
<b>LO2</b> Build a robot and appraise this from the perspectives of cost-benefit impact			
<b>P3</b> Assess all the components which are used to build a simple robot.  <b>P4</b> Build a fully functional simple robot.	<b>M2</b> Discuss the construction process and explain the cost-benefit impact.		
<b>LO3</b> Evaluate the operation and application of a range of sensors (e.g. vision, tactile) and how they can apply to a mobile or static robotic system			<b>LO3 &amp; LO4</b>  <b>D2</b> Embed the chosen biologically inspired techniques in the robot using appropriate tools and show the behavioural changes of the robot.
<b>P5</b> Evaluate a range of sensors and their use.  <b>P6</b> Embed a sensory system for the robot built in P4, to enhance the robots intelligence.	<b>M3</b> Critically analyse the construction process and explain the benefit of this upgrade.		
<b>LO4</b> Evaluate the relevance of biologically inspired robotic systems and how these can benefit both the understanding of biological systems and the design of individual or groups of robots			



Pass	Merit	Distinction
<p><b>P7</b> Evaluate the range of biologically inspired techniques which can be embedded within a robot.</p> <p><b>P8</b> Discuss how a biologically inspired robot can be used to study the understanding of the biological system.</p>	<p><b>M4</b> Choose a biologically inspired technique and analyse how the robot behaves after embedding the technique in the robot.</p>	

## Recommended Resources

### Textbooks

- Backstop Media and Waldron, R. (2015) *JavaScript Robotics: Building NodeBots with Johnny-Five, Raspberry Pi, Arduino, and BeagleBone*. Maker Media.
- Band, T., Mihelj, M., Lenarcic, J., Stanovnik, A. and Munih, M. (2010) *Robotics*. Springer, London.
- Ceceri, K. (2015) *Making Simple Robots*. Make Publications.
- Cook, D. (2015) *Robot Building for Beginners*. 3rd Ed. Apress.
- Corke, P. (2011) *Robotics: Vision and control*. Springer. Berlin.
- Donat, W. (2014) *Make a Raspberry Pi-Controlled Robot: Building a Rover with Python, Linux, Motors, and Sensors*. Maker Media.
- Grimmett, R. (2014) *Arduino Robotic Projects*. Packt Publishing.
- Grimmett, R. (2015) *Raspberry Pi Robotics Essentials*. Packt Publishing.
- Grimmett, R. (2015) *Raspberry Pi Robotics Projects*. 2nd Ed. Packt Publishing.
- Siciliano, B., Sciavicco L., Villani L. and Oriolo G. (2010) *Robotics: Modelling, planning and control*. Springer. London.

### Links

This unit links to the following related units:

*Unit 26: Machine Learning*

*Unit 27: Artificial Intelligence*

# **Unit 45: Emerging Technologies**

**Unit code** R/615/1695

**Unit level** 5

**Credit value** 15

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## **Introduction**

Emerging Technologies have the ability to disrupt industries, radically change the progress and thinking of humankind, affect society at large and solve huge problems. Computing underpins many Emerging Technologies and allows rapid development and sharing of ideas, products and scientific understanding to occur across multiple fields in shorter and shorter timeframes. The objective and effect of Emerging Technologies is usually to change the status quo. This change might be to solve problems, increase performance, improve efficiency, or create entirely new scientific fields and novel technologies by converging different systems, technology, thinking or disciplines together. Emerging Technologies explore a variety of changing technologies that display radical novelty, have the potential for significant commercial or social impact, fast growth, scalability and affect the future in uncertain ways.

This unit introduces students to the role, benefits, disadvantages and potential outcomes Emerging Technologies have in the development of software applications. The aim of the unit is to enhance the student's understanding of the current state, terminology, advantages, disadvantages, potential impact and benefits of Emerging Technologies on the development of software applications.

Among the topics included in this unit are: classification and terminology of Emerging Technologies, review the most promising and impactful Emerging Technologies, trends of convergence, the impact of computers in the development of Emerging Technologies, the hardware, software, data, platforms and services used to enable development of Emerging Technologies, understand the scale, scope, advantages and disadvantages Emerging Technologies may have on humankind.

On successful completion of this unit students will be able to explain some of the most promising and impactful Emerging Technologies. Have an awareness of the impact, advantages and disadvantages Emerging Technologies may have on humankind. Understand the impact Emerging Technologies will have on the development of software applications.

As a result they will develop skills such as communication literacy, design thinking, team working, critical thinking, analysis, reasoning, interpretation and computer software literacy, which are crucial for gaining employment and developing academic competence.

## Learning Outcomes

By the end of this unit students will be able to:

- LO1. Assess what Emerging Technologies are necessary and appropriate when designing software applications for the future.
- LO2. Research state-of-the-art Emerging Technologies and choose one you believe will have significant impact in the future.
- LO3. Discuss the current state and future impact of your chosen Emerging Technology.
- LO4. Evaluate the political, economic and social factors which play a role in the competition between Emerging Technologies and their success or failure in the future.

## Essential Content

### **L01 Assess what Emerging Technologies are necessary and appropriate when designing software applications for the future**

*Evaluate formats, characteristics and trends of Emerging Technologies:*

Present an overview of Emerging Technologies and their appropriate use in software development.

Assess what Emerging Technology is by researching its role, purpose and terminology.

Recognise the various forms of Emerging Technology by researching its history and current trends.

Define the characteristics of Emerging Technology by investigating how they can be used and how they differ from and converge with developed technology.

*Recognise specific Emerging Technologies:*

Research, debate and agree current trends in Emerging Technology.

Assess various forms of Emerging Technology, focusing on their relevance to software development and computing.

Define the advantages and disadvantages of Emerging Technology.

How Emerging Technologies can converge with existing technologies or replace them.

Appropriateness of using of Emerging Technology to disrupt the status quo throughout industries, markets, user adoption and established practices.

### **L02 Research state-of-the-art Emerging Technologies and choose one you believe will have significant impact in the future**

*Investigate a specific Emerging Technology and how it will affect the status quo of an industry, end user group and the current state of technology development:*

Investigate a specific Emerging Technology for discussion choosing one you believe will have the most impact to software application design and development in the future.

Choose a specific industry and end user group that will be the most influenced by this Emerging Technology.

Evaluate the benefits, features, advantages and disadvantages of this Emerging Technology.

**LO3 Discuss the current state and future impact of your chosen Emerging Technology**

*Develop a report and presentation using research gathered about your chosen Emerging Technology, industry and end user:*

Organise your research and findings.

Contrast the benefits, features, advantages and disadvantages of your chosen Emerging Technology.

Relate how your chosen Emerging Technologies can converge with existing technologies or replace them.

Defend your choice of Emerging Technology in relation to your belief it will have the most impact on software application design and development in the future.

Develop a report of your research and findings.

**LO4 Evaluate the political, economic and social factors which play a role in the competition between Emerging Technologies and their success or failure in the future**

*Assess the success of your research:*

Arrange a presentation to demonstrate your findings, gather feedback and answer questions.

Assemble and appraise your report findings and research.

Evaluate the political, economic and social factors which play a role in the competition between Emerging Technologies and their success or failure in the future.

Discuss how your chosen Emerging Technologies can converge with existing technologies or replace them.

## Learning Outcomes and Assessment Criteria

Pass		Merit	Distinction
<b>LO1</b> Assess what Emerging Technologies are necessary and appropriate when designing software applications for the future			<b>D1</b> Evaluate Emerging Technologies and justify their use when designing software applications for the future.
<b>P1</b> Assess formats, characteristics and trends of Emerging Technologies. <b>P2</b> Explore the advantages and disadvantages of Emerging Technology.	<b>M1</b> Evaluate the ability of Emerging Technology to disrupt the status quo throughout industries, markets, user adoption and established practices. <b>M2</b> Review various forms of Emerging Technologies, focusing on their relevance to software development and computing.		
<b>LO2</b> Research state-of-the-art Emerging Technologies and choose one you believe will have significant impact in the future			<b>LO2 &amp; LO3</b> <b>D2</b> Defend your choice of Emerging Technology in relation to your belief it will have the most impact on software application design and development in the future.
<b>P3</b> Select a specific Emerging Technology. <b>P4</b> Review a specific industry and end user group that will be the most influenced by this Emerging Technology.	<b>M3</b> Evaluate the benefits, features, advantages and disadvantages of this Emerging Technology. <b>M4</b> Show how Emerging Technologies can converge with existing technologies or replace them.		
<b>LO3</b> Discuss the current state and future impact of your chosen Emerging Technology			
<b>P5</b> Organise your research and findings. <b>P6</b> Contrast the benefits, features, advantages and disadvantages of your chosen Emerging Technology.	<b>M5</b> Relate how your chosen Emerging Technologies can converge with existing technologies or replace them. <b>M6</b> Develop a report of your research and findings.		

Pass	Merit	Distinction
<b>LO4</b> Evaluate the political, economic and social factors which play a role in the competition between Emerging Technologies and their success or failure in the future		<b>D3</b> Critique the benefits, features, advantages and disadvantages of your chosen Emerging Technology.
<b>P7</b> Evaluate your report findings and research.	<b>M7</b> Arrange a presentation to demonstrate your findings, gather feedback and answer questions.	



## Recommended Resources

### Textbooks

Christensen, C. (2015) *The Innovator's Dilemma: When New Technologies Cause Great Firms to Fail (Management of Innovation and Change)*. Harvard Business Review Press.

Masters, B. (2014) *From Zero to One: Notes on Startups, or How to Build the Future*. Virgin Digital.

Schwab, K. (2016) *The Fourth Industrial Revolution*. World Economic Forum.

### Links

This unit links to the following related units:

*Unit 14: Business Intelligence*

# Unit 46: Virtual & Augmented Reality Development

Unit code	Y/615/1696
Unit level	5
Credit value	15

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## Introduction

Virtual (VR) and Augmented (AR) Reality is the process by which you can use computer software and hardware technologies to develop fully immersive, simulated virtual reality environments or augment the real world with virtual reality content. The objective of Virtual and Augmented Reality development is to design virtual environments or real world augmentations for numerous beneficial, experimental, educational or entertainment purposes. VR and AR explores the potential to work, interact, play, collaborate and communicate in expansive simulated environments or use technology to enhance the real world with some of the benefits and features of simulated virtual environments.

This unit introduces students to the role, basic concepts and benefits of VR and AR technology and how to apply them in the development of VR/AR computer applications. The aim of the unit is to enhance the student's understanding of the methodology, terminology and benefits of VR and AR software applications.

Among the topics included in this unit are: classification and terminology of VR and AR technology, the relationship between VR and AR design, how VR and AR development relates to and differs from other forms of software development, modes of interaction, human-computer interaction models, usability, accessibility, aesthetics, spatial design, 3D vision, motion tracking, understand the hardware, software, data, platforms and services available to develop VR and AR software applications.

On successful completion of this unit students will be able to explain the basic concepts of VR and AR development. Plan, build and measure the success of an appropriate VR or AR software application. Design a VR or AR software application. As a result they will develop skills such as communication, literacy, design thinking, team working, critical thinking, analysis, reasoning, interpretation and computer software literacy, which are crucial for gaining employment and developing academic competence.

## Learning Outcomes

By the end of this unit students will be able to:

- LO1. Examine what aspects of VR and AR technology are necessary and appropriate when designing VR and AR software applications.
- LO2. Plan an appropriate VR or AR software application using common architecture, frameworks, tools, hardware and APIs.

- LO3. Design, build and simulate a VR or AR software application using any combination of hardware, software, data, platforms and services.
- LO4. Evaluate your VR or AR software application and detail the problems and limitations your application encountered and the reaction your VR or AR application generated with end users.

## Essential Content

### **L01 Examine what aspects of VR and AR technology are necessary and appropriate when designing VR and AR software applications**

*Identify formats, characteristics and aspects of VR/AR technology:*

Present an overview of VR/AR technology and its appropriate use in software development.

Identify what AR/VR is by researching the role, purpose, terminology and methodology of this technology.

Recognise the various forms of AR/VR technology by researching its history, current trends and use in the product development lifecycle.

Define the characteristics of AR/VR by investigating how it is similar to and differs from traditional simulated and virtual environments.

*Recognise specific forms of AR/VR technology:*

Research, debate and agree current functionality and capabilities of AR/VR technology.

Identify various forms of AR/VR technology and end user hardware.

Identify architecture, frameworks, tools, hardware and APIs available to develop applications.

Define the advantages and disadvantages of AR/VR technology.

*Define standard tools available for use in developing AR/VR applications:*

Identify standard tools available to develop AR/VR applications.

The advantages and disadvantages of AR/VR tools and hardware.

Appropriateness of various tools to develop AR and VR applications.

### **L02 Plan an appropriate VR or AR software application using common architecture, frameworks, tools, hardware and APIs**

*Identify an application concept to develop in AR/VR:*

Evaluate the benefits, features, advantages and disadvantages of AR/VR technology to develop this application.

*Review different AR/VR architecture, frameworks, tools, hardware and API techniques you could apply to develop this application.*

Select the most appropriate AR/VR architecture, frameworks, tools, hardware and API techniques to include in this application.

*Describe a plan to develop your AR/VR application concept:*

Use your selected techniques to create an AR/VR application development plan.

**L03 Design, build and simulate a VR or AR software application using any combination of hardware, software, data, platforms and services**

*Utilise appropriate tools and techniques to develop an AR/VR application:*

Employ an appropriate set of tools to develop your plan into an AR/VR application.

Run end user experiments and examine feedback.

Reconcile and evaluate end user feedback and determine advantages and disadvantages of your chosen AR/VR techniques.

**L04 Evaluate your VR or AR software application and detail the problems and limitations your application encountered and the reaction your VR or AR application generated with end users**

*Assemble and appraise end use feedback from your AR/VR application:*

Undertake a critical review and compare your final application with the original plan.

Evaluate the advantages, disadvantages, strengths and weaknesses of your AR/VR techniques.

Critique the overall success of your application. Was it successful? How did users react to it?

Discusses your insight using AR/VR Technology.

## Learning Outcomes and Assessment Criteria

Pass		Merit	Distinction
<b>LO1</b> Examine what aspects of VR and AR technology are necessary and appropriate when designing VR and AR software applications			<b>LO1 &amp; LO2</b>  <b>D1</b> Evaluate the benefits, features, advantages and disadvantages of AR/VR technology to develop this application.
<b>P1</b> Explore specific forms of AR/VR technology.  <b>P2</b> Review standard architecture, frameworks, tools, hardware and APIs available for use in AR/VR development.	<b>M1</b> Evaluate the impact of common AR/VR architecture, frameworks, tools, hardware and APIs in the software development lifecycle.		
<b>LO2</b> Plan an appropriate VR or AR software application using common architecture, frameworks, tools, hardware and APIs			
<b>P3</b> Investigate architecture, frameworks, tools, hardware and API techniques you could apply to develop this application.	<b>M2</b> Select the most appropriate AR/VR architecture, frameworks, tools, hardware and API techniques to include in an application to solve this problem.  <b>M3</b> Use your selected techniques to create an AR/VR application development plan.		
<b>LO3</b> Design, build and simulate a VR or AR software application using any combination of hardware, software, data, platforms and services			<b>D2</b> Make multiple iterations of your application and modify each iteration with enhancements gathered from user feedback and experimentation.
<b>P4</b> Employ an appropriate set of tools to develop your plan into an application.  <b>P5</b> Run end user experiments and examine feedback.	<b>M4</b> Reconcile and evaluate end user feedback.  <b>M5</b> Determine the advantages and disadvantages of your chosen techniques.		

Pass	Merit	Distinction
<b>LO4</b> Evaluate your VR or AR software application and detail the problems and limitations your application encountered and the reaction your VR or AR application generated with end users		<b>D3</b> Critique the overall success of your application and discuss your insight using AR/VR technology.
<b>P6</b> Assemble and appraise end use feedback from your AR/VR application.	<b>M6</b> Undertake a critical review and compare your final application with the original plan.	

## Recommended Resources

### Textbooks

Parisi, T. (2015) *Learning Virtual Reality: Developing Immersive Experiences and Applications for Desktop, Web and Mobile*. O'Reilly Media.

Schmalstieg, D. (2016) *Augmented Reality: Principles and Practice (Usability)*. Addison-Wesley Professional.

### Links

This unit links to the following related units:

*Unit 29: Application Program Interfaces*

*Unit 43: Internet of Things*



# Unit 47: Games Development

**Unit code** D/615/1697

**Unit level** 5

**Credit value** 15

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## Introduction

In the field of computing, games development is a multidisciplinary art form that creates worlds that blend player psychology, problem-solving and artificial intelligence with knowledge about dedicated hardware and software platforms. This level of ability can often require significant effort on the part of the student with regards to time and practice. However, as more experience is gained, the skills and abilities quickly improve. In addition, once completed it is important to know that the capabilities and flexibility of a good games developer can easily be transferred to other roles in the business sector.

This unit introduces students to games development and is designed to simulate the roles and responsibilities of a games developer working in a suitable games development studio with access to a small team of colleagues. Students are expected to discuss and review a number of original game ideas before synthesising them into a single game concept. Once defined they will need to adopt and use appropriate methods and practices to analyse, breakdown and discuss the issues – then, decide, design, create and test a functional game. Students should be free to debate, evaluate and select different design and development methodologies depending on their own judgement and consideration. On completion, and in addition to the student reviewing and reflecting on the experience, they will be expected to formally evaluate their completed game against their Games Design Document and original concept.

Among the topics included in this unit are: game design and developer documentation, problem analysis, research, system and user requirements, design methodologies and principles, development methodologies, unified modelling language (UML), software development lifecycles, games engines, hardware platforms, graphic manipulation, physics, maths for games, sound, networking, collision detection, teamwork, peer-reviews, development tools and techniques, integrated development environments, debugging, testing, software versions and quality assurance.

On successful completion of this unit students will be able to develop a Game Design Document by evaluating and synthesising game ideas into an original video game concept, select and use different design and development methodologies with tools and techniques associated with the creation of a video game, work individually and as part of a team to plan, prepare and produce a functional video game including support documentation, assess and plan improvements to a video game by evaluating its performance against its Game Design Document and original concept.

As a result they will develop skills such as communication literacy, critical thinking, analysis, reasoning and interpretation, which are crucial for gaining employment and developing academic competence.

## Learning Outcomes

By the end of this unit students will be able to:

- LO1. Develop a Game Design Document by evaluating and synthesising game ideas into an original video game concept.
- LO2. Use different design and development methodologies with tools and techniques associated with the creation of a video game.
- LO3. Work individually and as part of a team to plan and produce a functional video game, including support documentation.
- LO4. Evaluate the performance of a video game against its Game Design Document and original concept.

## Essential Content

### **LO1 Develop a Game Design Document by evaluating and synthesising game ideas into an original video game concept**

*Research and compare different game genres and ideas:*

Discuss and compare common game elements such as: type, story, characters, environment, levels, gameplay, loops, art, sound, user interface and controls.

Determine possible game ideas and predict the overall success of fully developing your game.

*Develop a Game Design Document:*

Review and discuss the value of Game Design Documents with regards to games development.

Evaluate and synthesise your game ideas into a single document that describes (in detail) your game concept.

Research and use information relating to games testing to create a suitable test plan for your game.

### **LO2 Use different design and development methodologies with tools and techniques associated with the creation of a video game**

*Discuss different design and development methodologies:*

Present overviews on current design and development methodologies.

Debate various strengths and weaknesses commonly associated with each methodology.

Select or synthesise a design and development methodology for use with the creation of your video game.

*Use appropriate tools and techniques:*

Evaluate different tools and techniques available to create a video game.

Establish your development plan by debating the advantages and disadvantages of your preferred or selected tools and techniques.

### **LO3 Work individually and as part of a team to plan and produce a functional video game, including support documentation**

*Work as a small team to plan and prepare your functional video game:*

Peer-review and debate your development plan and Games Design Document by effectively communicating and defending your ideas and reasoning.

Discuss differences with regards to the possible strengths and weakness of each Game Design Document and development plan.

Modify your design document or plans to reflect any new insights or considerations.

*Prepare and produce a functional video game:*

Use your Game Design Document with your development plan to produce a functional video game.

Create and quality check appropriate support documents for your video game.

#### **LO4 Evaluate the performance of a video game against its Game Design Document and original concept**

*Assess the performance of a video game:*

Analyse factors that influence the performance of a video game with regard to its system requirements.

Undertake a critical review of the performance and development of your video game against all identified factors and any adopted design and development methodologies.

Measure the overall success of the video game against your original prediction and identify any new areas of personal insight.

*Plan improvements to a video game:*

Evaluate the overall strengths and weaknesses of your video game against its Game Design Document and original concept.

Discuss and plan in detail possible revisions (including implementation) with regard to improving your video game's performance.

## Learning Outcomes and Assessment Criteria

Pass	Merit	Distinction
<b>LO1</b> Develop a Game Design Document by evaluating and synthesising game ideas into an original video game concept		<b>D1</b> Evaluate common game design elements and justify their use when designing a suitable Game Design Document.
<b>P1</b> Explore different game-based ideas, blending them into an original video game concept.  <b>P2</b> Examine any areas of risk related to the successful completion of your video game.	<b>M1</b> Analyse and combine common game design elements (such as type, story, characters, environment, levels, gameplay, loops, art, sound, user interface and controls) with your original video game concept to create a suitable Game Design Document.	
<b>LO2</b> Use different design and development methodologies with tools and techniques associated with the creation of a video game		<b>LO2 &amp; LO3</b>  <b>D2</b> Evaluate any new insights, ideas or potential improvements to your concept, methodology or use of tools and justify the reasons why you have chosen to include (or not to include) them as part of this development.
<b>P3</b> Research the use of different design and development methodologies, tools and techniques and determine which have been selected for the development of this video game.	<b>M2</b> Compare the differences between the various design and development methodologies, tools and techniques researched and justify your preferred selection.	

Pass	Merit	Distinction
<b>LO3</b> Work individually and as part of a team to plan and produce a functional video game, including support documentation		
<b>P4</b> Create a formal presentation that effectively reviews your video game concept together with your preferred design and development methodologies and selected tools and techniques. Use this presentation as part of a peer-review and document any feedback given.  <b>P5</b> Develop a functional video game based on a specified game concept.	<b>M3</b> Interpret your peer-review feedback and identify opportunities not previously considered.  <b>M4</b> Develop a functional video game based on a specific Game Design Document with supportive evidence of using the preferred design and development methodologies and selected tools and techniques.	
<b>LO4</b> Evaluate the performance of a video game against its Game Design Document and original concept		
<b>P6</b> Evaluate the performance of your video game against your original concept.	<b>M5</b> Critically analyse the factors that influence the performance of a video game and use them to undertake a critical review of the design, development, game elements and testing stages of your video game. Conclude your review by reflectively discussing your previously identified risks.	
		<b>D3</b> Critically evaluate the strengths and weaknesses of your video game and fully justify opportunities for improvement and further development.

## Recommended Resources

### Textbooks

Gibson, J. (2014) *Introduction to Game Design, Prototyping, and Development*. New Jersey: Pearson Education.

Gregory, J. (2014) *Game Engine Architecture*. United States: Taylor.

Madhav, S. (2013) *Game Programming Algorithms and Techniques*. USA: Addison-Wesley.

Nystrom, R. (2014) *Game Programming Patterns*. USA: Genever Benning.

Rogers, S. (2014) *Level Up! The Guide to Great Video Game Design*. UK: John Wiley and Sons Ltd.

Schell, J. (2014) *The Art of Game Design: A Book of Lenses*. USA: A K Peters/CRC Press.

### Links

This unit links to the following related units:

*Unit 9: Software Development Lifecycles*

*Unit 31: Games Engine & Scripting*

*Unit 32: Game Design Theory*

# Unit 48: Systems Integration

**Unit code** H/615/1698

**Unit level** 5

**Credit value** 15

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## Introduction

Large organisations and businesses are composed of different functional areas, such as finance, HR, customer management, engineering services, product manufacturing, storage and warehousing. These functional areas carry out different operations in order to fulfil the goals of the business and often use a variety of different IT systems (e.g. stock control, accounts, HR, etc.) from a range of different suppliers and vendors to service their needs. The success of any large business or enterprise in achieving its goals depends on the ability of IT systems to effectively communicate with each other. However, IT systems from different vendors or suppliers often use different hardware and/or software platforms and services, thus creating the need for systems integration.

This unit introduces students to enterprise business requirements, and the need and purpose of systems integration to support organisational goals. Students are expected to gather and review business objectives with the aim of developing a systems specification document. As part of a feasibility analysis, students are expected to evaluate factors and issues affecting the successful completion of integration, including describing and documenting the functional architecture and design of a system. Students are also expected to explore hardware and software technologies used to connect systems and subsystems and establish an integration methodology to design and implement an integrated solution. In addition, students will investigate and compare different cloud service models and evaluate different deployment methods and consider their effect on systems integration.

Among the topics included in this unit are: enterprise business objectives, purpose and operation of systems integration, systems specification documents, feasibility analysis, risk assessments, architectural development, hardware and software technologies for systems integration, operational configuration, systems integration design framework, design, development and deployment of a systems integration solution, quality assurance, cloud services as a systems integration provision, cloud service models and different deployment models, such as private and public cloud services.

On successful completion of this unit students will be able to analyse systems integration requirements with regard to business objectives, investigate different hardware and software systems with regard to connectivity, communication and data transfer, prepare a suitable integrated solution based on a set of business requirements and compare a range of cloud computing providers and evaluate their services.

As a result they will develop skills such as communication literacy, critical thinking, analysis, reasoning and interpretation, which are crucial for gaining employment and developing academic competence.



## Learning Outcomes

By the end of this unit students will be able to:

- LO1. Analyse systems integration requirements with regards to business objectives.
- LO2. Investigate different hardware and software systems with regards to connectivity, communication and data transfer.
- LO3. Prepare a suitable integrated solution based on a set of business requirements.
- LO4. Compare a range of cloud computing providers and evaluate their services.

## Essential Content

### L01 **Analyse systems integration requirements with regards to business objectives**

#### *Identifying business objectives:*

Introduce and outline the purpose and operation of 'systems integration'.

Gathering and reviewing business objectives, including interpreting business needs from different functional areas and departments.

Developing a systems specification document, including establishing and ensuring requirements can be met.

#### *Feasibility analysis:*

Using risk assessments to evaluate issues threatening the successful completion of integrating systems, including identifying any reasonable steps necessary to prevent or mitigate issues.

Architectural development; describe and document the functional architecture and design of the system and specify all technical requirements and capabilities.

### L02 **Investigate different hardware and software systems with regards to connectivity, communication and data transfer**

#### *Exploring hardware and software technologies:*

Research and evaluate hardware and software servers, technologies, platforms and services.

Connecting systems and subsystems, including custom software services and development.

#### *Establish a systems integration methodology:*

Operational configuration: exploring requirements, information needs and facilitating data transfer and communication.

Identifying and tracking issues for problem resolution and fault detection, including diagnosing type and location.

Implementing a design framework: using top-down and bottom-up methodologies.

**L03 Prepare a suitable integrated solution based on a set of business requirements**

*Establishing a strategic approach:*

Analyse functional architecture and technical capabilities against a specification document to determine the probability of successfully developing (and deploying) an effective integrated solution.

Establishing a management strategy.

*System design, development and deployment:*

Designing, developing and monitoring an integrated system.

Quality Assurance, including deploying and testing an integrated system.

Evaluating system functionality: documentation, maintenance and upgrades.

**L04 Compare a range of cloud computing providers and evaluate their services**

*Investigating and comparing cloud service models:*

Introduce and discuss IaaS (Infrastructure as a Service).

Review and debate PaaS (Platform as a Service).

Research and discuss: SaaS (Software as a Service).

*Investigating and comparing deployment models:*

Research and discuss private, public and hybrid clouds.

Evaluating issues: security, privacy and constraints.

## Learning Outcomes and Assessment Criteria

Pass		Merit	Distinction
<b>LO1</b> Analyse systems integration requirements with regards to business objectives			<b>LO1 &amp; LO2</b> <b>D1</b> Critically evaluate your detailed 'System Specification' and 'Risk Assessment' document, including justification on how each of the specified business objectives has been met.
<b>P1</b> Discuss the objectives and effect of 'Systems Integration' with regards to business operations and management.  <b>P2</b> Prepare a suitable 'Systems Specification' and 'Risk Assessment' document for a set of specific business objectives.	<b>M1</b> Evaluate the processes involved in 'System Integration' and review the purpose and impact of assessing risk.  <b>M2</b> Provide a detailed 'Systems Specification' and 'Risk Assessment' document.		
<b>LO2</b> Investigate different hardware and software systems with regards to connectivity, communication and data transfer			
<b>P3</b> Discuss a range of hardware and software systems, technologies, platforms and services that would be suitable for use with a given 'Systems Specification' document.  <b>P4</b> Determine the purpose of top-down and bottom-up methodologies and how they relate to 'Systems Integration'.	<b>M3</b> Provide a detailed and evaluated review of your selected systems, platforms, technologies and services and include details on system and service connectivity.		

Pass	Merit	Distinction
<b>LO3</b> Prepare a suitable integrated solution based on a set of business requirements		<b>LO3 &amp; LO4</b>  <b>D2</b> Critically evaluate the impact of cloud services on 'Systems Integration' and discuss the implications of 'IaaS', 'PaaS' and 'SaaS' and how they could be used to help organisations improve their performance.
<b>P5</b> Create an 'Integrated Systems' solution to a set of specific business objectives using existing 'Systems Specification and Risk Assessment' documents, including illustrated design diagrams and details on information flow.  <b>P6</b> Create a systems deployment and test plan suitable for use with your 'Integrated Systems' solution.	<b>M4</b> Provide a detailed and evaluated 'Integrated Systems' solution, including fully annotated diagrams, details on information flow, risk, redundant systems, backups, security, connectivity, deployment, testing and a full review of the solution's functionality compared to the 'Systems Specification' document.	
<b>LO4</b> Compare a range of cloud computing providers and evaluate their services.		
<b>P7</b> Discuss the differences between 'IaaS', 'PaaS' and 'SaaS' services and compare the 'private', 'public' and 'hybrid' deployment models offered by cloud computing providers.	<b>M5</b> Review a range of cloud computing providers and compare the services offered.	

## Recommended Resources

### Textbooks

Erl, T., Mahmood, Z. and Puttini, R. (2014) *Cloud Computing: Concepts, Technology & Architecture*. USA: Prentice Hall

Paul, D., Yeates, D. and Cadle, J. (2010) *Business Analysis*. UK: BCS.

Poulton, N. (2016) *CompTIA Server+ Study Guide: Exam SK0-004*. USA: John Wiley & Sons Inc.

### Links

This unit links to the following related units:

*Unit 16: Cloud Computing*

# Unit 49: Operating Systems

**Unit code** R/615/1700

**Unit level** 5

**Credit value** 15

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## Introduction

Although many computer users do not interact directly with systems software and hardware, it is important that computing students have the opportunity to learn about these underlying systems.

MS-DOS, Windows, UNIX, Linux, Android, OS2, MacOS are just a few examples of different types of both modern and legacy Operating Systems. The foundations of most, if not all of them, is MS-DOS (Microsoft Disk Operating System). Way back in the 1980s this was used as the first Operating System for Personal Computers (PCs). In the 1990s, MS-DOS was transformed to a GUI (Graphic User Interface) WSWIG (What You See Is What You Get) Operating System through the release of Windows 3.11/Windows for Workgroups. That has led to several iterations of the Windows Operating System.

This unit introduces students to different operating systems such as DOS, Windows, UNIX and Linux. The topics covered are the tasks of operating systems such as controlling and allocating memory, prioritising system requests, controlling input and output devices, facilitating data networking and managing files, including security and protection.

Among the topics included in this unit are: the history and evolution of Operating Systems; the definition of an Operating System; why Operating Systems are needed; how Operating Systems started and developed; Operating Systems management roles; management of memory, processes, processors, devices and files; security and protection: user security, device, application and process protection; inter-process communication; comparison of Operating Systems; distributed and networked systems; concurrent systems; multi-user systems; graphical interface systems; and practical application of Operating Systems: user interface commands of major Operating Systems; installations and extensions of Operating Systems.

On successful completion of this unit students will be able to competently operate any given Operating System and undertake routine maintenance of Operating System as well as their optimisation. As a result they will develop skills such as communication literacy, critical thinking, analysis, reasoning and interpretation, which are crucial for gaining employment and developing academic competence.

## **Learning Outcomes**

By the end of this unit students will be able to:

- LO1. Investigate different Operating Systems, their functions and user interfaces.
- LO2. Explore the processes managed by an Operating System.
- LO3. Demonstrate the use of DOS, Windows, UNIX and Linux.
- LO4. Analyse appropriate techniques and technologies used in distributed and concurrent systems.



## Essential Content

### **L01 Investigate different Operating Systems, their functions and user interfaces**

*The history of Operating Systems:*

Discuss the history of Operating Systems from Legacy Operating Systems to current Operating Systems, tracking its development from Batch files to the modern Operating Systems.

*History and evolution of operating systems:*

Discuss what is meant by an Operating System; why do we need Operating Systems? How did Operating Systems start and develop throughout the ages? What constitutes an Operating System?

### **L02 Explore the processes managed by an Operating System**

*Operating Systems Management:*

Discuss in detail how Memory Management is conducted in an Operating System.

Discuss how job scheduling is handled by an Operating System. Discuss how Process Scheduling happens in an Operating System. How does concurrent processing happen in an Operating System. Discuss how device management is accomplished by an Operating System. File Management is a crucial element for an Operating System, discuss how this is performed by an Operating System.

### **L03 Demonstrate the use of DOS, Windows, UNIX and Linux**

*Commands for manipulating:*

Interaction with different Operating Systems requires knowledge of certain commands and knowledge of manipulating them. You are required to research several MS-DOS, Windows, UNIX and Linux commands.

Consider how secure different Operating Systems are.

### **L04 Analyse appropriate techniques and technologies used in distributed and concurrent systems**

*Critical evaluation of an Operating System environment:*

Operating Systems can be used for a number of domains. Your task is to evaluate different Operating Systems' environments, including Distributed Operating Systems as well as Concurrent Operating Systems, etc.

## Learning Outcomes and Assessment Criteria

Pass		Merit	Distinction
<b>LO1</b> Investigate different Operating Systems, their functions and user interfaces			<b>LO1 &amp; LO2</b> <b>D1</b> Critically evaluate with an aid of a diagram(s) an algorithm that can be used to manage resources in an Operating System.
<b>P1</b> Explore what an Operating System is. <b>P2</b> Research the evolution of Operating Systems.	<b>M1</b> Discuss the importance of Operating Systems.		
<b>LO2</b> Explore the processes managed by an Operating System			
<b>P3</b> Research the process of Memory Management in an Operating System. <b>P4</b> Investigate the process of job scheduling.	<b>M2</b> Analyse, with the aid of a diagram, the importance of Resource Management in an Operating System to aid its efficiency.		
<b>LO3</b> Demonstrate the use of DOS, Windows, UNIX and Linux			<b>D2</b> Analyse the future of Operating Systems with reference to Virtualisation.
<b>P5</b> With an aid of screenshots, prove the use of MS-DOS and Windows. <b>P6</b> With an aid of screenshots, prove the use of UNIX and Linux and MacOS.	<b>M3</b> Evaluate the security of each Operating System discussed in P5 and P6.		
<b>LO4</b> Analyse appropriate techniques and technologies used in distributed and concurrent systems			<b>D3</b> Critically evaluate your work and make some recommendations about current Operating Systems and future advancements.
<b>P7</b> Discuss distributed Operating Systems. <b>P8</b> Discuss Concurrent Operating Systems.	<b>M4</b> Justify which techniques and technologies you would use in a Distributed Operating system.		

## Recommended Resources

### Textbooks

Davis, W.S. and Rajkumar, T.M. (2004) *Operating Systems: A Systematic View*. 3rd Ed. Harlow, Addison-Wesley.

McHoes, A.M. and Flynn, I.M. (2007) *Understanding Operating Systems*. 5th Ed. Course Technology.

Nutt, G.J. and Clegg, N. (2003) *Operating Systems*. International Edition. Harlow, Addison-Wesley.

O'Gorman, J. (2000) *Operating Systems (Grassroots)*. Basingstoke. Palgrave Macmillan.

Ritchie, C. (2002) *Operating Systems*, 4th Ed. London, Thomson Learning.

Silberschatz, A. and Galvin, P. (1998) *Operating System Concepts*. Harlow. Addison-Wesley.

Stallings, W. (2001) *Operating Systems: Internals and Design Principles*. London. Prentice Hall.

Tanenbaum, A.S. (2001) *Modern Operating Systems*. Upper Saddle River. Prentice Hall.

Woodhull, A.S. and Tanenbaum, A.S. (2006) *Operating Systems: Design and Implementation*. 3rd Ed. Upper Saddle River. Prentice Hall.

### Links

This unit links to the following related units:

*Unit 36: Client/Server Computing Systems*

## 11. Appendices

## Appendix 1: Professional Body Memberships

Qualification	Membership/Specialist Group
Higher National Certificate in Computing	Student Membership
Higher National Diploma in Computing	Student Membership Associate Membership (on completion) Business Information Systems Specialist Group
Higher National Diploma in Computing (Network Engineering)	Student Membership Associate Membership (on completion) Distributed and Scalable Computing Specialist Group
Higher National Diploma in Computing (Software Engineering)	Student Membership Associate Membership (on completion) Advanced Programming Specialist Group Open Source Specialist Group Software Testing Specialist Group
Higher National Diploma in Computing (Systems Data & Analysis)	Student Membership Associate Membership (on completion) Data Management Specialist Group Information Risk Management and Assurance Specialist Group
Higher National Diploma in Computing (Security)	Student Membership Associate Membership (on completion) Cybercrime Forensics Specialist Group Information Security Specialist Group
Higher National Diploma in Computing (Intelligent Systems)	Student Membership Associate Membership (on completion) Artificial Intelligence Specialist Group Cybernetic Machine Specialist Group

Qualification	Membership/Specialist Group
Higher National Diploma in Computing (Applications Development)	Student Membership Associate Membership (on completion)
Higher National Diploma in Computing (All Pathways)	Project Management Specialist Group Quality Specialist Group Requirements engineering Specialist Group

## Appendix 2: Vendor Accredited Certifications

<b>CompTIA</b>	
Server+	Unit 36: Client/Server Computing Systems
	Unit 48: Systems Integration
Linux+	Unit 36: Client/Server Computing Systems
	Unit 49: Operating Systems
Network+	Unit 2: Networking
	Unit 35: Network Management
Security+	Unit 5: Security
	Unit 17: Network Security
	Unit 23: Cryptography
	Unit 24: Forensics
Cloud+	Unit 16: Cloud Computing
A+	Unit 8: Computer Systems Architecture
<b>CISCO</b>	
IT Essentials	Unit 8: Computer Systems Architecture
CCNA Routing & Switching	Unit 2: Networking
	Unit 8: Computer Systems Architecture
	Unit 15: Transport Network Design
	Unit 35: Network Management

CCNA Security	Unit 2: Networking
	Unit 8: Computer Systems Architecture
	Unit 15: Transport Network Design
	Unit 17: Network Security
	Unit 35: Network Management
<b>Microsoft</b>	
Microsoft Office Specialist (MOS) certification	Throughout
<b>Oracle</b>	
Java SE 8 Fundamentals	Unit 1: Programming
	Unit 20: Advanced Programming
Introduction to SQL	Unit 4: Database Design & Development
	Unit 19: Data Structures & Algorithms
	Unit 38: Database Management Systems
Oracle Database 12c Administration	Unit 8: Computer Systems Architecture
	Unit 19: Data Structures & Algorithms
	Unit 38: Database Management Systems



<b>AXELOS</b>	
Prince2 Foundation Qualification	Unit 13: Computing Research Project
Cyber Resilience Qualification (RESILIA)	Unit 5: Security
	Unit 17: Network Security
	Unit 23: Cryptography
	Unit 24: Forensics

## Appendix 3: SFIA Skill Levels

### SFIA LEVEL 3 SKILLS

Skill	Description	
Information security	The selection, design, justification, implementation and operation of controls and management strategies to maintain the security, confidentiality, integrity, availability, accountability and relevant compliance of information systems with legislation, regulation and relevant standards.	Communicates information security risks and issues to business managers and others. Performs basic risk assessments for small information systems. Contributes to vulnerability assessments. Applies and maintains specific security controls as required by organisational policy and local risk assessments. Takes action to respond to security breaches in line with security policy and records the incidents and action taken.
Analytics	The validation and analysis of significant volumes of data, including the ability to discover and quantify patterns and trends in numbers, symbols, text, sound and image. Relevant techniques may include statistical and data mining algorithms and machine learning methods such as rule induction, artificial neural networks, genetic algorithms and automated indexing systems.	Undertakes analytical activities and delivers analysis outputs, in accordance with customer needs and conforming to agreed standards.
Information content publishing	The evaluation and application of different publishing methods and options, recognising key features, including open source and proprietary options. The management and tuning of the processes that collect, assemble and publish information, including in unstructured and semi-structured forms, for delivery to the user at the point at which it is needed. The management of copyright, data protection and other legal issues associated with publishing and re-use of published information and data.	Specifies and creates content management processes to meet the needs of users. Selects appropriate platforms for publishing, applying the concept of customer journey. Uses content publishing systems and publishing content across different channels, including mobile and social media. Takes account of the implications of copyright, data protection and other legal issues associated with publishing. Contributes to achievement of search engine optimisation.

Skill	Description	
Research	The advancement of knowledge by data gathering, innovation, experimentation, evaluation and dissemination, carried out in pursuit of a predetermined set of research goals.	Within given research goals, builds on and refines appropriate outline ideas for research, i.e. evaluation, development, demonstration and implementation. Uses available resources to gain an up-to-date knowledge of any relevant field. Reports on work carried out and may contribute sections of material of publication quality.
Data management	The management of practices and processes to ensure the security, integrity, safety and availability of all forms of data and data structures that make up the organisation's information. The management of data and information in all its forms and the analysis of information structure (including logical analysis of taxonomies, data and metadata). The development of innovative ways of managing the information assets of the organisation.	Applies ethical and robust techniques in the transformation of data from one format/medium to another, in line with organisational policies and procedures and being sensitive to risks around the use of information.
Portfolio, programme and project support	The provision of support and guidance on portfolio, programme and project management processes, procedures, tools and techniques. Support includes definition of portfolios, programmes, and projects; advice on the development, production and maintenance of business cases; time, resource, cost and exception plans, and the use of related software tools. Tracking and reporting of programme/project progress and performance are also covered, as is the capability to facilitate all aspects of portfolio/programme/project meetings, workshops and documentation.	Uses recommended portfolio, programme and project control solutions for planning, scheduling and tracking. Sets up project files, compiles and distributes reports. Provides administrative services to project boards, project assurance teams and quality review meetings. Provides guidance on project management software, procedures, processes, tools and techniques.

Skill	Description	
Business analysis	<p>The methodical investigation, analysis, review and documentation of all or part of a business in terms of business functions and processes, the information used and the data on which the information is based. The definition of requirements for improving processes and systems, reducing their costs, enhancing their sustainability, and the quantification of potential business benefits. The collaborative creation and iteration of viable specifications and acceptance criteria in preparation for the deployment of information and communication systems.</p>	<p>Investigates operational needs and problems, and opportunities, contributing to the recommendation of improvements in automated and non-automated components of new or changed processes and organisation. Assists in defining acceptance tests for these recommendations.</p>
Requirements definition and management	<p>The definition and management of the business goals and scope of change initiatives. The specification of business requirements to a level that enables effective delivery of agreed changes.</p>	<p>Defines scope and business priorities for small-scale changes and may assist in larger scale scoping exercises. Elicits and discovers requirements from operational management and other stakeholders. Selects appropriate techniques for the elicitation of detailed requirements taking into account the nature of the required changes, established practice and the characteristics and culture of those providing the requirements. Specifies and documents business requirements as directed, ensuring traceability back to source. Analyses them for adherence to business objectives and for consistency, challenging positively as appropriate. Works with stakeholders to prioritise requirements.</p>

Skill	Description	
Business modelling	The production of abstract or distilled representations of real world, business or gaming situations in traditional or trans-media applications, to aid the communication and understanding of existing, conceptual or proposed scenarios. Predominantly focused around the representation of processes, roles, data, organisation and time. Models may be used to represent a subject at varying levels of detail and decomposition.	Conversant with techniques covering full range of modelling situations. Models current and desired scenarios as directed. Selects appropriate modelling techniques for meeting assigned objectives. Gains agreement from subject matter experts to models produced. Reviews resulting models with stakeholders and gains resolution to resultant issues.
Data analysis	The investigation, evaluation, interpretation and classification of data, in order to define and clarify information structures which describe the relationships between real world entities. Such structures facilitate the development of software systems, links between systems or retrieval activities.	Applies data analysis, data modelling, and quality assurance techniques, based upon a detailed understanding of business processes, to establish, modify or maintain data structures and associated components (entity descriptions, relationship descriptions, attribute definitions). Advises database designers and other application development team members on the details of data structures and associated components.
Systems design	The specification and design of information systems to meet defined business needs in any public or private context, including commercial, industrial, scientific, gaming and entertainment. The identification of concepts and their translation into implementable design. The design or selection of components. The retention of compatibility with enterprise and solution architectures, and the adherence to corporate standards within constraints of cost, security and sustainability.	Specifies user/system interfaces, and translates logical designs into physical designs taking account of target environment, performance security requirements and existing systems. Produces detailed designs and documents all work using required standards, methods and tools, including prototyping tools where appropriate.

Skill	Description	
Database design	The specification, design and maintenance of mechanisms for storage and access to both structured and unstructured information, in support of business information needs.	Develops specialist knowledge of database concepts, object and data modelling techniques and design principles. Translates object and data models into appropriate database schemas within design constraints. Interprets installation standards to meet project needs and produces database components as required. Evaluates potential solutions, demonstrating, installing and commissioning selected products.
Programming/software development	The design, creation, testing and documenting of new and amended software components from supplied specifications in accordance with agreed development and security standards and processes.	Designs, codes, tests, corrects, and documents moderately complex programs and scripts from agreed specifications and subsequent iterations, using agreed standards and tools. Collaborates in reviews of specifications, with others as appropriate.
Safety engineering	The application of appropriate methods to assure safety during all lifecycle phases of safety-related systems developments, including maintenance and re-use. These include safety hazard and risk analysis, safety requirements specification, safety-related system architectural design, formal method design, safety validation and verification, and safety case preparation.	Assists with the collection of safety assurance evidence, undertaking all work in accordance with agreed safety, technical and quality standards, using appropriate methods and tools. Documents the results of hazard and risk analysis activities.

Skill	Description	
Information content authoring	The management and application of the principles and practices of designing, creation and presentation of textual information, supported where necessary by graphical content for interactive and digital uses. The adoption of workflow principles and definition of user roles and engagement and training of content providers. This material may be delivered electronically (for example, as collections of web pages) or otherwise. This skill includes managing the quality assurance and authoring processes for the material being produced.	Liaises with clients/users to clarify details of requirements. Designs, creates and tests moderately complex subject matter, using easily understood language. Designs content for search engine optimisation, making informed decisions about the best way to present information to users. Ensures that content is accurate, relevant and current and takes into account user needs.
Testing	The planning, design, management, execution and reporting of tests, using appropriate testing tools and techniques and conforming to agreed process standards and industry specific regulations. The purpose of testing is to ensure that new and amended systems, configurations, packages, or services, together with any interfaces, perform as specified (including security requirements), and that the risks associated with deployment are adequately understood and documented. Testing includes the process of engineering, using and maintaining testware (test cases, test scripts, test reports, test plans, etc.) to measure and improve the quality of the software being tested.	Reviews requirements and specifications, and defines test conditions. Designs test cases and test scripts under own direction, mapping back to pre-determined criteria, recording and reporting outcomes. Analyses and reports test activities and results. Identifies and reports issues and risks associated with own work.
User experience analysis	The identification, analysis, clarification and communication of the context of use in which applications will operate, and of the goals of products, systems or services. Analysis and prioritisation of stakeholders' 'user experience' needs and definition of required system behaviour and performance. Resolution of potential conflicts between user requirements and determination of usability objectives	Identifies and engages with users/ stakeholders, defines relevant characteristics (e.g. 'personas') and describes users goals and tasks (e.g. as 'user stories'). Describes the environment within which the system will be used. Identifies and describes requirements of users with special needs (e.g. resulting from physical disabilities).

Skill	Description	
User experience design	The iterative development of user tasks, interaction and interfaces to meet user requirements, considering the whole user experience. Refinement of design solutions in response to user-centred evaluation and feedback and communication of the design to those responsible for implementation.	Develops visual user experiences across digital assets (web and other digital channels). Works as part of a team to translate digital concepts into consistent graphical representations under creative direction. Supports the capture of business requirements from clients and users, and translates requirements into design briefs. Produces accessible user experiences, prototypes and final assets. Defines cost effective and efficient digital solutions, proactively resolves technical problems and ensures that technical solutions continue to meet business requirements.
User experience evaluation	Evaluation of systems, products or services, to assure that the stakeholder and organisational requirements have been met, required practice has been followed, and systems in use continue to meet organisational and user needs. Iterative assessment (from early prototypes to final live implementation) of effectiveness, efficiency, user satisfaction, health and safety, and accessibility to measure or improve the usability of new or existing processes, with the intention of achieving optimum levels of product or service usability.	Evaluate prototypes to obtain user feedback on requirements of developing systems. Tests the usability of component systems, and alternative designs, administering formative and summative usability tests, logging and analysing data. Check systems for adherence to applicable human science knowledge, style guides, guidelines, standards and legislation. Evaluates the usability of existing or competitor systems to provide benchmark values and as input to design.



Skill	Description	
Systems integration	The incremental and logical integration and testing of components and/or subsystems and their interfaces in order to create operational services.	Defines the integration build and produces a build definition for generation of the software. Accepts software modules from software developers, and produces software builds for loading onto the target hardware from software source code. Configures the hardware environment, produces integration test specifications, conducts tests and records the details of any failures. Carries out and reports fault diagnosis relating to moderately complex problems.
Porting/software configuration	The configuration of software products into new or existing software environments/platforms.	Assists in the configuration of software and equipment and the systems testing of platform-specific versions of one or more software products. Documents faults, implements resolutions and retests to agreed standards.
Systems installation/decommissioning	The installation, testing, implementation or decommissioning and removal of cabling, wiring, equipment, hardware and associated software, following plans and instructions and in accordance with agreed standards. The testing of hardware and software components, resolution of malfunctions, and recording of results. The reporting of details of hardware and software installed so that configuration management records can be updated.	Installs or removes hardware and/or software, using supplied installation instructions and tools including, where appropriate, handover to the client. Conducts tests, corrects malfunctions, and documents results in accordance with agreed procedures. Reports details of all hardware/software items that have been installed and removed so that configuration management records can be updated. Provides assistance to users in a professional manner following agreed procedures for further help or escalation.

Skill	Description	
		Reviews change requests. Maintains accurate records of user requests, contact details and outcomes. Contributes to the development of installation procedures and standards.
Service level management	The planning, implementation, control, review and audit of service provision, to meet customer business requirements. This includes negotiation, implementation and monitoring of service level agreements, and the ongoing management of operational facilities to provide the agreed levels of service, seeking continually and proactively to improve service delivery and sustainability targets.	Monitors service delivery performance metrics and liaises with managers and customers to ensure that service level agreements are not breached without the stakeholders being given the opportunity of planning for a deterioration in service.
Configuration management	The lifecycle planning, control and management of the assets of an organisation (such as documentation, software and service assets, including information relating to those assets and their relationships. This involves identification, classification and specification of all configuration items (CIs) and the interfaces to other processes and data. Required information relates to storage, access, service relationships, versions, problem reporting and change control of CIs. The application of status accounting and auditing, often in line with acknowledged external criteria such as ISO 9000, ISO/IEC 20000, ISO/IEC 27000 and security throughout all stages of the CI lifecycle, including the early stages of system development.	Applies tools, techniques and processes to track, log and correct information related to CIs, ensuring protection of assets and components from unauthorised change, diversion and inappropriate use.

Skill	Description	
Change management	The management of change to the service infrastructure including service assets, configuration items and associated documentation. Change management uses requests for change (RFC) for standard or emergency changes, and changes due to incidents or problems to provide effective control and reduction of risk to the availability, performance, security and compliance of the business services impacted by the change.	Develops, documents and implements changes based on requests for change. Applies change control procedures.
Release and deployment	The management of the processes, systems and functions to package, build, test and deploy changes and updates (which are bounded as 'releases') into a live environment, establishing or continuing the specified Service, to enable controlled and effective handover to Operations and the user community.	Uses the tools and techniques for specific areas of release and deployment activities. Administers the recording of activities, logging of results and documents technical activity undertaken. May carry out early life support activities such as providing support advice to initial users.
System software	The provision of specialist expertise to facilitate and execute the installation and maintenance of system software such as operating systems, data management products, office automation products and other utility software.	Uses system management software and tools to collect agreed performance statistics. Carries out agreed system software maintenance tasks.
Security administration	The provision of operational security management and administrative services. Typically includes the authorisation and monitoring of access to IT facilities or infrastructure, the investigation of unauthorised access and compliance with relevant legislation.	Investigates minor security breaches in accordance with established procedures. Assists users in defining their access rights and privileges. Performs non-standard security administration tasks and resolves security administration issues.

Skill	Description	
Application support	The provision of application maintenance and support services, either directly to users of the systems or to service delivery functions. Support typically includes investigation and resolution of issues and may also include performance monitoring. Issues may be resolved by providing advice or training to users, by devising corrections (permanent or temporary) for faults, making general or site-specific modifications, updating documentation, manipulating data, or defining enhancements support often involves close collaboration with the system's developers and/or with colleagues specialising in different areas, such as database administration or network support.	Identifies and resolves issues with applications, following agreed procedures. Uses application management software and tools to collect agreed performance statistics. Carries out agreed applications maintenance tasks.
IT Infrastructure	The operation and control of the IT infrastructure (typically hardware, software, data stored on various media, and all equipment within wide and local area networks) required to deliver and support IT services and products to meet the needs of a business. Includes preparation for new or changed services, operation of the change process, the maintenance of regulatory, legal and professional standards, the building and management of systems and components in virtualised computing environments and the monitoring of performance of systems and services in relation to their contribution to business performance, their security and their sustainability.	Carries out agreed operational procedures, including network configuration, installation and maintenance. Uses network management tools to collect and report on network load and performance statistics. Contributes to the implementation of maintenance and installation work. Uses standard procedures and tools to carry out defined system backups, restoring data where necessary. Identifies operational problems and contributes to their resolution.
Database administration	The installation, configuration, upgrade, administration, monitoring and maintenance of databases.	Uses database management system software and tools to collect agreed performance statistics. Carries out agreed database maintenance and administration tasks.

Skill	Description	
Storage management	The planning, implementation, configuration and tuning of storage hardware and software covering online, offline, remote and offsite data storage (backup, archiving and recovery) and ensuring compliance with regulatory and security requirements.	Performs regular high-performance, scalable backups and restores on a schedule and tracks offsite storage. Carries out documented configuration for allocation of storage, installation and maintenance of secure storage systems as per the agreed operational procedure (e.g. using replication software to allow resilience). Identifies operational problems and contributes to their resolution (e.g. monitoring SAN for disk failures and replacing). Uses standard management and reporting tools to collect and report on storage utilisation, performance and backup statistics.
Network support	The provision of network maintenance and support services. Support may be provided both to users of the systems and to service delivery functions. Support typically takes the form of investigating and resolving problems and providing information about the systems. It may also include monitoring their performance. Problems may be resolved by providing advice or training to users about the network's functionality, correct operation or constraints, by devising work-arounds, correcting faults, or making general or site-specific modifications.	Identifies and resolves network problems following agreed procedures. Uses network management software and tools to collect agreed performance statistics. Carries out agreed network maintenance tasks.
Problem management	The resolution (both reactive and proactive) of problems throughout the information system lifecycle, including classification, prioritisation and initiation of action, documentation of root causes and implementation of remedies to prevent future incidents.	Investigates problems in systems, processes and services. Assists with the implementation of agreed remedies and preventative measures.

Skill	Description	
Incident management	The processing and coordination of appropriate and timely responses to incident reports, including channelling requests for help to appropriate functions for resolution, monitoring resolution activity, and keeping clients apprised of progress towards service restoration.	Following agreed procedures, identifies, registers and categorises incidents. Gathers information to enable incident resolution and promptly allocates incidents as appropriate. Maintains records and advises relevant persons of actions taken.
Facilities management	The planning, control and management of all the facilities which, collectively, make up the IT estate. This involves provision and management of the physical environment, including space and power allocation, and environmental monitoring to provide statistics on energy usage. Encompasses physical access control, and adherence to all mandatory policies and regulations concerning health and safety at work.	Monitors compliance against agreed processes and investigates, assesses and resolves incidents of non-compliance, escalating where necessary. Grants users required physical accesses and monitors and reports on overall access control.
Learning and development management	The provision of learning and development processes (including learning management systems) in order to develop the professional, business and/or technical skills required by the organisation.	Contributes to the maintenance and updates of training records and training catalogue.
Learning assessment and evaluation	The assessment of knowledge, skills and behaviour by any means whether formal or informal against capability and qualification frameworks such as SFIA. The evaluation of learning or education programmes against defined outcomes.	Performs routine assessments of knowledge and experience using specified methods and according to specified standards.
Learning delivery	The transfer of business and/or technical skills and knowledge and the promotion of professional attitudes in order to facilitate learning and development. Uses a range of techniques, resources and media (which might include eLearning, on-line virtual environments, self-assessment, peer-assisted learning, simulation, and other current methods).	Delivers learning activities to a variety of audiences.

Skill	Description	
Quality assurance	The process of ensuring that the agreed quality standards within an organisation are adhered to and that best practice is promulgated throughout the organisation.	Uses appropriate methods and tools in the development, maintenance, control and distribution of quality and environmental standards. Makes technical changes to quality and environmental standards according to documented procedures. Distributes new and revised standards.
Quality standards	The development, maintenance, control and distribution of quality standards.	Controls, updates and distributes new and revised quality standards.
Conformance review	The independent assessment of the conformity of any activity, process, deliverable, product or service to the criteria of specified standards, best practice, or other documented requirements. May relate to, for example, asset management, Network Security tools, firewalls and internet security, sustainability, real-time systems, application design and specific certifications.	Collects and collates evidence as part of a formally conducted and planned review of activities, processes, products or services. Examines records as part of specified testing strategies for evidence of compliance with management directives, or the identification of abnormal occurrences.
Sourcing	The provision of policy, internal standards and advice on the procurement or commissioning of externally supplied and internally developed products and services. The provision of commercial governance, conformance to legislation and assurance of information security. The implementation of compliant procurement processes, taking full account of the issues and imperatives of both the commissioning and supplier sides. The identification and management of suppliers to ensure successful delivery of products and services required by the business.	Prepares pre-qualification questionnaires and tender invitations in response to business cases. Recognises the difference between open source and proprietary systems options. Produces detailed evaluation criteria for more complex tenders and assists in evaluation of tenders. Acts as the routine contact point between organisation and supplier. Collects and reports on supplier performance data.

Skill	Description	
Customer service support	The management and operation of one or more customer service or service desk functions. Acting as a point of contact to support service users and customers reporting issues, requesting information, access, or other services.	Acts as the routine contact point, receiving and handling requests for support. Responds to a broad range of service requests for support by providing information to fulfil requests or enable resolution. Provides first line investigation and diagnosis and promptly allocates unresolved issues as appropriate. Assists with the development standards, and applies these to track, monitor, report, resolve or escalate issues. Contributes to creation of support documentation.
Sales support	The provision of technical advice and assistance to the sales force, sales agents, reseller/distributor staff and existing or prospective customers, either in support of customer development or sales activity or in fulfilment of sales obligations.	Provides customer service, including technical advice and guidance on all matters bearing on the successful use of complex products and services. Helps customers to clarify their requirements; documents the conclusions reached, and contributes to preparing and supporting bids and sales proposals.
Product management	The active management of a product or service throughout its lifecycle (inception through to retirement) in order to address a market opportunity/customer need and generate the greatest possible value for the business.	Carries out research and performance monitoring activities for specified products. Develops marketing collateral content and evaluates results and feedback from marketing campaigns.



## SFIA LEVEL 4 SKILLS

Skill	Description	
Information management	The overall governance of how all types of information, structured and unstructured, whether produced internally or externally, are used to support decision-making, business processes and digital services. Encompasses development and promotion of the strategy and policies covering the design of information structures and taxonomies, the setting of policies for the sourcing and maintenance of the data content, and the development of policies, procedures, working practices and training to promote compliance with legislation regulating all aspects of holding, use and disclosure of data.	Understands and complies with relevant organisational policies and procedures, taking responsibility for assessing and managing risks around the use of information. Ensures that information is presented effectively. Ensures that effective controls are in place for internal delegation, audit and control and that the board receives timely reports and advice that will inform their decisions.
Information security	The selection, design, justification, implementation and operation of controls and management strategies to maintain the security, confidentiality, integrity, availability, accountability and relevant compliance of information systems with legislation, regulation and relevant standards.	Explains the purpose of and provides advice and guidance on the application and operation of elementary physical, procedural and technical security controls. Performs security risk, vulnerability assessments, and business impact analysis for medium complexity information systems. Investigates suspected attacks and manages security incidents. Uses forensics where appropriate.
Analytics	The validation and analysis of significant volumes of data, including the ability to discover and quantify patterns and trends in numbers, symbols, text, sound and image. Relevant techniques may include statistical and data mining algorithms and machine learning methods such as rule induction, artificial neural networks, genetic algorithms and automated indexing systems.	Applies a variety of analytical and visualisation techniques, in consultation with experts if appropriate, and with sensitivity to the limitations of the techniques.

Skill	Description	
Information content publishing	The evaluation and application of different publishing methods and options, recognising key features, including open source and proprietary options. The management and tuning of the processes that collect, assemble and publish information, including in unstructured and semi-structured forms, for delivery to the user at the point at which it is needed. The management of copyright, data protection and other legal issues associated with publishing and re-use of published information and data.	Defines and manages content management processes to meet the needs of users. Select appropriate channels through which content should be published. Uses appropriate tools and techniques to provide moderately complex interfaces to new or existing platforms and applications. Applies propriety guidelines. Identifies the implications of copyright, data protection and other legal issues associated with publishing. Applies search engine optimisation techniques, and facilitates ease of use in delivered digital services.
Technical specialism	The development and exploitation of expertise in any specific area of information or communications technology, technique, method, product or application area.	Maintains knowledge of specific specialisms, provides detailed advice regarding their application and executes specialised tasks. The specialism can be any area of information or communication technology, technique, method, product or application area.
Research	The advancement of knowledge by data gathering, innovation, experimentation, evaluation and dissemination, carried out in pursuit of a predetermined set of research goals.	Contributes to research goals and builds on and refines appropriate outline ideas for the evaluation, development, demonstration and implementation of research. Reports on work carried out and may contribute significant sections of material of publication quality. Contributes to research plans and identifies appropriate opportunities for publication and dissemination of research findings.

Skill	Description	
Financial management	The overall financial management, control and stewardship of the IT assets and resources used in the provision of IT services, including the identification of materials and energy costs, ensuring compliance with all governance, legal and regulatory requirements.	Monitors and maintains all required financial records for compliance and audit to all agreed requirements. Assists all other areas of IT with their financial tasks, especially in the areas of identification of process, service, project and component costs and the calculation and subsequent reduction of all IT service, project, component and process failures. Contributes to financial planning and budgeting. Collates required financial data and reports for analysis and to facilitate decision making.
Business risk management	The planning and implementation of organisation-wide processes and procedures for the management of risk to the success or integrity of the business, especially those arising from the use of information technology, reduction or non-availability of energy supply or inappropriate disposal of materials, hardware or data.	Investigates and reports on hazards and potential risk events within a specific function or business area.
Sustainability strategy	The preparation of a sustainability strategy, taking into account any established corporate strategy, to be used as a basis for policies and planning, and covering both consumption and sources of supply of energy and materials. Evaluation and inclusion, as appropriate, of political, legislative, economic, social and technological factors. Identification of major external standards, practices or schemes to be adopted. Consultation with identified relevant parties, either internal or external. Obtaining agreement to the strategy and the commitment to act upon it.	Assesses and reports on how different tactical decisions affect organisational sustainability. Evaluates factors and risks (political, legislative, technological, economic, and social) that impact on operational processes and strategic direction.

Skill	Description	
Emerging technology monitoring	The identification of new and emerging hardware, software and communication technologies and products, services, methods and techniques and the assessment of their relevance and potential value as business enablers, improvements in cost/performance or sustainability. The promotion of emerging technology awareness among staff and business management.	Maintains awareness of opportunities provided by new technology to address challenges or to enable new ways of working. Within own sphere of influence, works to further organisational goals, by the study and use of emerging technologies and products. Contributes to briefings and presentations about their relevance and potential value to the organisation.
Continuity management	The provision of service continuity planning and support. This includes the identification of information systems which support critical business processes, the assessment of risks to those systems' availability, integrity and confidentiality and the co-ordination of planning, designing, testing and maintenance procedures and contingency plans to address exposures and maintain agreed levels of continuity. This function should be performed as part of, or in close cooperation with, the function which plans business continuity for the whole organisation.	Provides input to the service continuity planning process and implements resulting plans.
Data management	The management of practices and processes to ensure the security, integrity, safety and availability of all forms of data and data structures that make up the organisation's information. The management of data and information in all its forms and the analysis of information structure (including logical analysis of taxonomies, data and metadata). The development of innovative ways of managing the information assets of the organisation.	Takes responsibility for the accessibility, retrievability and security of specific subsets of data. Assesses the integrity of data from multiple sources (including, for example, from sensors measurement systems). Provides advice on the transformation of data/information from one format/medium to another, where appropriate.

Skill	Description	
		Maintains and implements information handling procedures. Enables the availability, integrity and searchability of information through the application of formal data structures and protection measures. Manipulates specific data from information services, to satisfy local or specific information needs.
Methods and tools	Ensuring that appropriate methods and tools for the planning, development, testing, operation, management and maintenance of systems are adopted and used effectively throughout the organisation.	Provides expertise and support on use of methods and tools.
Project management	The management of projects, typically (but not exclusively) involving the development and implementation of business processes to meet identified business needs, acquiring and utilising the necessary resources and skills, within agreed parameters of cost, timescales, and quality.	Defines, documents and carries out small projects or sub-projects (typically less than six months, with limited budget, limited interdependency with other projects, and no significant strategic impact), alone or with a small team, actively participating in all phases. Identifies, assesses and manages risks to the success of the project. Agrees project approach with stakeholders, and prepares realistic plans (including quality, risk and communications plans) and tracks activities against the project schedule, managing stakeholder involvement as appropriate. Monitors costs, timescales and resources used, and takes action where these deviate from agreed tolerances. Ensures that own projects are formally closed and, where appropriate, subsequently reviewed, and that lessons learned are recorded.

Skill	Description	
Portfolio, programme and project support	<p>The provision of support and guidance on portfolio, programme and project management processes, procedures, tools and techniques. Support includes definition of portfolios, programmes, and projects; advice on the development, production and maintenance of business cases; time, resource, cost and exception plans, and the use of related software tools. Tracking and reporting of programme/project progress and performance are also covered, as is the capability to facilitate all aspects of portfolio/ programme/ project meetings, workshops and documentation.</p>	<p>Takes responsibility for the provision of support services to projects. Uses and recommends project control solutions for planning, scheduling and tracking projects. Sets up and provides detailed guidance on project management software, procedures, processes, tools and techniques. Supports programme or project control boards, project assurance teams and quality review meetings. Provides basic guidance on individual project proposals. May be involved in aspects of supporting a programme by providing a cross programme view on risk, change, quality, finance or configuration management.</p>
Business analysis	<p>The methodical investigation, analysis, review and documentation of all or part of a business in terms of business functions and processes, the information used and the data on which the information is based. The definition of requirements for improving processes and systems, reducing their costs, enhancing their sustainability, and the quantification of potential business benefits. The collaborative creation and iteration of viable specifications and acceptance criteria in preparation for the deployment of information and communication systems.</p>	<p>Investigates operational requirements, problems, and opportunities, seeking effective business solutions through improvements in automated and non-automated components of new or changed processes. Assists in the analysis of stakeholder objectives, and the underlying issues arising from investigations into business requirements and problems, and identifies options for consideration. Works iteratively with stakeholders, to identify potential benefits and available options for consideration, and in defining acceptance tests.</p>

Skill	Description	
Requirements definition and management	The definition and management of the business goals and scope of change initiatives. The specification of business requirements to a level that enables effective delivery of agreed changes.	Facilitates scoping and business priority-setting for change initiatives of medium size and complexity. Contributes to selection of the most appropriate means of representing business requirements in the context of a specific change initiative, ensuring traceability back to source. Discovers and analyses requirements for fitness for purpose as well as adherence to business objectives and consistency, challenging positively as appropriate. Obtains formal agreement by stakeholders and recipients to scope and requirements and establishes a base-line on which delivery of a solution can commence. Manages requests for and the application of changes to base-lined requirements. Identifies the impact on business requirements of interim (e.g. migration) scenarios as well as the required end position.
Business process testing	The planning, design, management, execution and reporting of business process tests and usability evaluations. The application of evaluation skills to the assessment of the ergonomics, usability and fitness for purpose of defined processes. This includes the synthesis of test tasks to be performed (from statement of user needs and user interface specification), the design of an evaluation programme, the selection of user samples, the analysis of performance, and inputting results to the development team.	Specifies and develops test scenarios to test that new/updated processes deliver improved ways of working for the end user at the same time as delivering efficiencies and planned business benefits. Records and analyses test results, and reports any unexpected or unsatisfactory outcomes. Uses test plans and outcomes to specify user instructions.

Skill	Description	
Business modelling	The production of abstract or distilled representations of real world, business or gaming situations in traditional or trans-media applications, to aid the communication and understanding of existing, conceptual or proposed scenarios. Predominantly focused around the representation of processes, roles, data, organisation and time. Models may be used to represent a subject at varying levels of detail and decomposition.	Conducts advanced modelling activities for significant change programmes and across multiple business functions. Has an in-depth knowledge of organisation-standard techniques. Plans own modelling activities, selecting appropriate techniques and the correct level of detail for meeting assigned objectives. May contribute to discussions about the choice of the modelling approach to be used. Obtains input from and communicates modelling results to senior managers for agreement.
Sustainability assessment	The evaluation of the sustainability of operational or planned services, devices and day-to-day operations such as travel. The establishment of a model or scheme to track changes in consumption over time and to generate feedback to enable improvements in energy or resource efficiency. The identification of areas requiring attention, and the initiation of actions to change or control the procurement of energy or other resources, so as to improve sustainability.	Assesses, records and reports on utilisation of energy and other resources, showing expertise in a given area such as a class of computing devices, or business travel. Provides advice on the improvement of sustainability in that area of expertise.
Data analysis	The investigation, evaluation, interpretation and classification of data, in order to define and clarify information structures which describe the relationships between real world entities. Such structures facilitate the development of software systems, links between systems or retrieval activities.	Investigates corporate data requirements, and applies data analysis, data modelling and quality assurance techniques, to establish, modify or maintain data structures and their associated components (entity descriptions, relationship descriptions, attribute definitions). Provides advice and guidance to database designers and others using the data structures and associated components.



Skill	Description	
Systems design	The specification and design of information systems to meet defined business needs in any public or private context, including commercial, industrial, scientific, gaming and entertainment. The identification of concepts and their translation into implementable design. The design or selection of components. The retention of compatibility with enterprise and solution architectures, and the adherence to corporate standards within constraints of cost, security and sustainability.	Recommends/Designs structures and tools for systems which meet business needs and takes into account target environment, performance security requirements and existing systems. Delivers technical visualisation of proposed applications for approval by customer and execution by system developers. Translates logical designs into physical designs, and produces detailed design documentation. Maps work to user specification and removes errors and deviations from specification to achieve user-friendly processes.
Database design	The specification, design and maintenance of mechanisms for storage and access to both structured and unstructured information, in support of business information needs.	Develops and maintains specialist knowledge of database concepts, object and data modelling techniques and design principles and a detailed knowledge of database architectures, software and facilities. Analyses data requirements to establish, modify or maintain object/data models. Evaluates potential solutions, demonstrating, installing and commissioning selected products.
Programming/software development	The design, creation, testing and documenting of new and amended software components from supplied specifications in accordance with agreed development and security standards and processes.	Designs, codes, tests, corrects and documents complex programs and scripts from agreed specifications, and subsequent iterations, using agreed standards and tools, to achieve a well-engineered result. Takes part in reviews of own work and leads reviews of colleagues' work.

Skill	Description	
Safety engineering	The application of appropriate methods to assure safety during all lifecycle phases of safety-related systems developments, including maintenance and re-use. These include safety hazard and risk analysis, safety requirements specification, safety-related system architectural design, formal method design, safety validation and verification, and safety case preparation.	Contributes to the identification, analysis and documentation of hazards, and to the capture, evaluation and specification of safety requirements. Analyses and documents safety validation results. Contributes to the development and maintenance of project safety assurance plans, and gathers safety assurance evidence for safety case preparation.
Sustainability engineering	The development and application of appropriate knowledge and methods to assure sustainability in all phases of the life cycle of energy- or materials-consuming systems and services, including maintenance and re-use. These include such things as energy supply risk analysis, specification of guidelines for sustainable procurement of assets and materials, energy efficiency and sustainability factors influencing system design, system design for sustainable operation and use, efficient coding design and adoption of re-use/sharing principles, achieving behaviour change to more sustainable ways of working, and the verification of energy and resource efficiency in operation.	Investigates and recommends components and subsystems that meet sustainability criteria and levels.

Skill	Description	
Information content authoring	<p>The management and application of the principles and practices of designing, creation and presentation of textual information, supported where necessary by graphical content for interactive and digital uses. The adoption of workflow principles and definition of user roles and engagement and training of content providers. This material may be delivered electronically (for example, as collections of web pages) or otherwise. This skill includes managing the quality assurance and authoring processes for the material being produced.</p>	<p>Engages with senior content owners, using objective evidence to determine the content needs of users. Controls, monitors and evaluates web content to ensure quality, consistency and accessibility of messages. Designs the content and appearance of complex information deliverables (e.g. web pages) in collaboration with clients/users. Moderates content and ensures it can be reused. Creates and tests complex, well-engineered deliverables to support simple, clear, fast services. Interprets analytics data to optimise content so that it meets user needs and is optimised for search engines. Reviews work of other content designers for consistency and accuracy, and takes responsibility for its publication. Understand the implications of publishing content and manages the risks of doing so.</p>
Testing	<p>The planning, design, management, execution and reporting of tests, using appropriate testing tools and techniques and conforming to agreed process standards and industry specific regulations. The purpose of testing is to ensure that new and amended systems, configurations, packages, or services, together with any interfaces, perform as specified (including security requirements), and that the risks associated with deployment are adequately understood and documented.</p>	<p>Accepts responsibility for creation of test cases using own in-depth technical analysis of both functional and non-functional specifications (such as reliability, efficiency, usability, maintainability and portability). Creates traceability records, from test cases back to requirements.</p>

Skill	Description	
	<p>Testing includes the process of engineering, using and maintaining testware (test cases, test scripts, test reports, test plans, etc.) to measure and improve the quality of the software being tested.</p>	<p>Produces test scripts, materials and regression test packs to test new and amended software or services. Specifies requirements for environment, data, resources and tools. Interprets, executes and documents complex test scripts using agreed methods and standards. Records and analyses actions and results, and maintains a defect register. Reviews test results and modifies tests if necessary. Provides reports on progress, anomalies, risks and issues associated with the overall project. Reports on system quality and collects metrics on test cases. Provides specialist advice to support others.</p>
User experience analysis	<p>The identification, analysis, clarification and communication of the context of use in which applications will operate, and of the goals of products, systems or services. Analysis and prioritisation of stakeholders' 'user experience' needs and definition of required system behaviour and performance. Resolution of potential conflicts between user requirements and determination of usability objectives</p>	<p>Analyses qualitative data (e.g. from site visits) and presents the data in ways that can be used to drive design (e.g. personas, red routes, user journey maps). Describes the user/ stakeholder objectives for the system, and identifies the roles of affected stakeholder groups. Defines the required behaviour and performance of the system in terms of the total use experience (e.g. in the form of scenarios of use), resolving potential conflicts between user requirements, (e.g. between accuracy and speed). Specifies measurable criteria for the required usability of the system.</p>

Skill	Description	
User experience design	The iterative development of user tasks, interaction and interfaces to meet user requirements, considering the whole user experience. Refinement of design solutions in response to user-centred evaluation and feedback and communication of the design to those responsible for implementation.	Collaborates with colleagues from other disciplines to define technology objectives, assess solution options and devise architectural solutions that both achieve strategic business goals and meet operational requirements. Creates design briefs for new web and digital projects or refreshes of existing projects. Develops visual user experiences across digital assets, working with project teams to present propositions and strategies. Rapidly translates digital concepts into hi-fidelity visual outputs and interactive prototypes. Captures multi-disciplinary requirements, and translates those requirements into user experiences, prototypes and final assets. Plans and costs UX activities, building in time for iteration, user feedback and design changes, and articulating the costs and benefits of different design approaches.
User experience evaluation	Evaluation of systems, products or services, to assure that the stakeholder and organisational requirements have been met, required practice has been followed, and systems in use continue to meet organisational and user needs. Iterative assessment (from early prototypes to final live implementation) of effectiveness, efficiency, user satisfaction, health and safety, and accessibility to measure or improve the usability of new or existing processes, with the intention of achieving optimum levels of product or service usability.	Plans and performs all types of evaluation, in order to check that stakeholder and organisational requirements have been met, choosing between formative and summative usability tests. Selects and administers moderated or unmoderated usability tests. Tests developing systems to ensure compatibility with user requirements, tasks and environment, as defined in agreed specifications. Checks systems in use for changes in organisational, user, other stakeholder, and usability needs and to ensure that these needs continue to be met.

Skill	Description	
		Assesses the stability of requirements against changes in context of use. Interprets and presents results of evaluations to design team(s), prioritising usability issues.
Systems integration	The incremental and logical integration and testing of components and/or subsystems and their interfaces in order to create operational services.	Defines the integration build, accepts software modules from software developers, and produces software builds for loading onto the target environment. Configures the hardware environment, produces integration test specifications, and conducts tests, recording details of any failures and carrying out fault diagnosis.
Porting/software configuration	The configuration of software products into new or existing software environments/platforms.	Configures software and equipment and tests platform-specific versions of one or more software products. Reports the outcome of testing and identifies potential improvements to the process and to the software products according to agreed designs and standards.
Hardware design	The specification and design of computing and communications equipment (such as semiconductor processors, HPC architectures and DSP and graphics processor chips), typically for integration into, or connection to an IT infrastructure or network. The identification of concepts and their translation into implementable design. The selection and integration, or design and prototyping of components. The adherence to industry standards including compatibility, security and sustainability.	Designs computing and communications equipment, taking account of target environment, performance, security and sustainability requirements. Translates logical designs into physical designs, and delivers technical prototypes of proposed components for approval by customer and execution by technicians. Designs tests to measure performance of prototypes and production output against specification and inform iterative development.

Skill	Description	
Systems installation/decommissioning	<p>The installation, testing, implementation or decommissioning and removal of cabling, wiring, equipment, hardware and associated software, following plans and instructions and in accordance with agreed standards. The testing of hardware and software components, resolution of malfunctions, and recording of results. The reporting of details of hardware and software installed so that configuration management records can be updated.</p>	<p>Undertakes routine installations and de-installations of items of hardware and/or software. Takes action to ensure targets are met within established safety and quality procedures, including, where appropriate, handover to the client. Conducts tests of hardware and/or software using supplied test procedures and diagnostic tools. Corrects malfunctions, calling on other experienced colleagues and external resources if required. Documents details of all hardware/software items that have been installed and removed so that configuration management records can be updated. Develops installation procedures and standards, and schedules installation work. Provides specialist guidance and advice to less experienced colleagues to ensure best use is made of available assets, and to maintain or improve the installation service.</p>
Availability management	<p>The definition, analysis, planning, measurement, maintenance and improvement of all aspects of the availability of services, including the availability of power. The overall control and management of service availability to ensure that the level of service delivered in all services is matched to or exceeds the current and future agreed needs of the business, in a cost effective manner.</p>	<p>Contributes to the availability management process and its operation and performs defined availability management tasks. Analyses service and component availability, reliability, maintainability and serviceability. Ensures that services and components meet and continue to meet all of their agreed performance targets and service levels. Implements arrangements for disaster recovery and documents recovery procedures. Conducts testing of recovery procedures.</p>

Skill	Description	
Service level management	The planning, implementation, control, review and audit of service provision, to meet customer business requirements. This includes negotiation, implementation and monitoring of service level agreements, and the ongoing management of operational facilities to provide the agreed levels of service, seeking continually and proactively to improve service delivery and sustainability targets.	Performs defined tasks to monitor service delivery against service level agreements and maintains records of relevant information. Analyses service records against agreed service levels regularly to identify actions required to maintain or improve levels of service, and initiates or reports these actions.
Service acceptance	The achievement of formal confirmation that service acceptance criteria have been met, and that the service provider is ready to operate the new service when it has been deployed. (Service acceptance criteria are used to ensure that a service meets the defined service requirements, including functionality, operational support, performance and quality requirements).	Engages with project management to confirm that products developed meet the service acceptance criteria and are to the required standard. Feeds into change management processes.
Configuration management	The lifecycle planning, control and management of the assets of an organisation (such as documentation, software and service assets, including information relating to those assets and their relationships. This involves identification, classification and specification of all configuration items (CIs) and the interfaces to other processes and data. Required information relates to storage, access, service relationships, versions, problem reporting and change control of CIs. The application of status accounting and auditing, often in line with acknowledged external criteria such as ISO 9000, ISO/IEC 20000, ISO/IEC 27000 and security throughout all stages of the CI lifecycle, including the early stages of system development.	Maintains secure configuration, applying and maintaining tools, techniques and processes to identify, track, log and maintain accurate, complete and current information.



Skill	Description	
Asset management	The management of the lifecycle for all managed assets (hardware, software, intellectual property, licences, warranties etc.) including security, inventory, compliance, usage and disposal, aiming to protect and secure the corporate assets portfolio, optimise the total cost of ownership and sustainability by minimising operating costs, improving investment decisions and capitalising on potential opportunities. Knowledge and use of international standards for asset management and close integration with security, change, and configuration management are examples of enhanced asset management development.	Controls IT assets in one or more significant areas, ensuring that administration of the acquisition, storage, distribution, movement and disposal of assets is carried out. Produces and analyses registers and histories of authorised assets (including secure master copies of software, documentation, data, licenses and agreements for supply, warranty and maintenance), and verifies that all these assets are in a known state and location. Acts to highlight and resolve potential instances of unauthorised assets such as unlicensed copies of software.
Change management	The management of change to the service infrastructure including service assets, configuration items and associated documentation. Change management uses requests for change (RFC) for standard or emergency changes, and changes due to incidents or problems to provide effective control and reduction of risk to the availability, performance, security and compliance of the business services impacted by the change.	Assesses, analyses, develops, documents and implements changes based on requests for change.
Release and deployment	The management of the processes, systems and functions to package, build, test and deploy changes and updates (which are bounded as 'releases') into a live environment, establishing or continuing the specified Service, to enable controlled and effective handover to Operations and the user community.	Assesses and analyses release components. Provides input to scheduling. Carries out the builds and tests in coordination with testers and component specialists maintaining and administering the tools and methods – manual or automatic – and ensuring, where possible, information exchange with configuration management. Ensures release processes and procedures are maintained.

Skill	Description	
System software	The provision of specialist expertise to facilitate and execute the installation and maintenance of system software such as operating systems, data management products, office automation products and other utility software.	Reviews system software updates and identifies those that merit action. Tailors system software to maximise hardware functionality. Installs and tests new versions of system software. Investigates and coordinates the resolution of potential and actual service problems. Prepares and maintains operational documentation for system software. Advises on the correct and effective use of system software.
Capacity management	The management of the capability, functionality and sustainability of service components (including hardware, software, network resources and software/infrastructure as a Service) to meet current and forecast needs in a cost efficient manner aligned to the business. This includes predicting both long-term changes and short-term variations in the level of capacity required to execute the service, and deployment, where appropriate, of techniques to control the demand for a particular resource or service.	Monitors service component capacity and initiates actions to resolve any shortfalls according to agreed procedures. Applies techniques to control the demand upon a particular resource or service.
Security administration	The provision of operational security management and administrative services. Typically includes the authorisation and monitoring of access to IT facilities or infrastructure, the investigation of unauthorised access and compliance with relevant legislation.	Maintains security administration processes and checks that all requests for support are dealt with according to agreed procedures. Provides guidance in defining access rights and privileges. Investigates security breaches in accordance with established procedures and recommends required actions and supports/follows up to ensure these are implemented.

Skill	Description	
Penetration testing	<p>The assessment of organisational vulnerabilities through the design and execution of penetration tests that demonstrate how an adversary can either subvert the organisation's security goals (e.g. the protection of specific Intellectual Property) or achieve specific adversarial objectives (e.g. establishment of a covert Command and Control infrastructure). Pen Test results provide deeper insight into the business risks of various vulnerabilities.</p>	<p>Maintains current knowledge of malware attacks, and other cyber security threats. Creates test cases using in-depth technical analysis of risks and typical vulnerabilities. Produces test scripts, materials and test packs to test new and existing software or services. Specifies requirements for environment, data, resources and tools. Interprets, executes and documents complex test scripts using agreed methods and standards. Records and analyses actions and results. Reviews test results and modifies tests if necessary. Provides reports on progress, anomalies, risks and issues associated with the overall project. Reports on system quality and collects metrics on test cases. Provides specialist advice to support others.</p>
Application support	<p>The provision of application maintenance and support services, either directly to users of the systems or to service delivery functions. Support typically includes investigation and resolution of issues and may also include performance monitoring. Issues may be resolved by providing advice or training to users, by devising corrections (permanent or temporary) for faults, making general or site-specific modifications, updating documentation, manipulating data, or defining enhancements support often involves close collaboration with the system's developers and/or with colleagues specialising in different areas, such as database administration or network support.</p>	<p>Maintains application support processes, and checks that all requests for support are dealt with according to agreed procedures. Uses application management software and tools to investigate issues, collect performance statistics and create reports.</p>

Skill	Description	
IT Infrastructure	<p>The operation and control of the IT infrastructure (typically hardware, software, data stored on various media, and all equipment within wide and local area networks) required to deliver and support IT services and products to meet the needs of a business. Includes preparation for new or changed services, operation of the change process, the maintenance of regulatory, legal and professional standards, the building and management of systems and components in virtualised computing environments and the monitoring of performance of systems and services in relation to their contribution to business performance, their security and their sustainability.</p>	<p>Provides technical expertise to enable the correct application of operational procedures. Uses network management tools to determine network load and performance statistics. Contributes to the planning and implementation of maintenance and installation work, including building and management of systems and components in virtualised computing environments. Implements agreed network changes and maintenance routines. Identifies operational problems and contributes to their resolution, checking that they are managed in accordance with agreed standards and procedures. Provides reports and proposals for improvement, to specialists, users and managers.</p>
Database administration	<p>The installation, configuration, upgrade, administration, monitoring and maintenance of databases.</p>	<p>Uses database management system software and tools, and knowledge of logical database schemata, to investigate problems and collect performance statistics and create reports. Carries out routine configuration/installation and reconfiguration of database and related products.</p>

Skill	Description	
Storage management	The planning, implementation, configuration and tuning of storage hardware and software covering online, offline, remote and offsite data storage (backup, archiving and recovery) and ensuring compliance with regulatory and security requirements.	Reviews capacity, performance, availability and other operational metrics and take appropriate action to ensure corrective and proactive maintenance of storage and backup systems to support the requirement to protect and secure business information. Creates reports and proposals for improvement and contributes to the planning and implementation of new installations and scheduled maintenance and changes within the system. Prepares and maintains operational procedures and provides technical expertise and appropriate information to the management.
Network support	The provision of network maintenance and support services. Support may be provided both to users of the systems and to service delivery functions. Support typically takes the form of investigating and resolving problems and providing information about the systems. It may also include monitoring their performance. Problems may be resolved by providing advice or training to users about the network's functionality, correct operation or constraints, by devising work-arounds, correcting faults, or making general or site-specific modifications.	Maintains the network support process and checks that all requests for support are dealt with according to agreed procedures. Uses network management software and tools to investigate and diagnose network problems, collect performance statistics and create reports, working with users, other staff and suppliers as appropriate.
Problem management	The resolution (both reactive and proactive) of problems throughout the information system lifecycle, including classification, prioritisation and initiation of action, documentation of root causes and implementation of remedies to prevent future incidents.	Initiates and monitors actions to investigate and resolve problems in systems, processes and services. Determines problem fixes/remedies. Assists with the implementation of agreed remedies and preventative measures.

Skill	Description	
Incident management	The processing and coordination of appropriate and timely responses to incident reports, including channelling requests for help to appropriate functions for resolution, monitoring resolution activity, and keeping clients apprised of progress towards service restoration.	Prioritises and diagnoses incidents according to agreed procedures. Investigates causes of incidents and seeks resolution. Escalates unresolved incidents. Facilitates recovery, following resolution of incidents. Documents and closes resolved incidents according to agreed procedures.
Facilities management	The planning, control and management of all the facilities which, collectively, make up the IT estate. This involves provision and management of the physical environment, including space and power allocation, and environmental monitoring to provide statistics on energy usage. Encompasses physical access control, and adherence to all mandatory policies and regulations concerning health and safety at work.	Uses data centre management tools to produce management information on power, cooling and space and investigate issues where necessary. Carries out routine audit and checks to ensure adherence to policies and procedures. Facilitates the implementation of mandatory electrical safety testing.
Learning and development management	The provision of learning and development processes (including learning management systems) in order to develop the professional, business and/or technical skills required by the organisation.	Contributes to the development and maintenance of a catalogue of learning and development resources. Books and organises learning events. Updates and controls training records, including attainment of certificates and accreditations.
Learning assessment and evaluation	The assessment of knowledge, skills and behaviour by any means whether formal or informal against capability and qualification frameworks such as SFIA. The evaluation of learning or education programmes against defined outcomes.	Performs routine and non-routine assessments of knowledge, skills and behaviour using specified methods and according to specified standards. Gathers inputs for the analysis and evaluation of learning programmes.

Skill	Description	
Learning design and development	The specification, design, creation, packaging and maintenance of materials and resources for use in learning and development in the workplace or in compulsory, further or higher education. Typically involves the assimilation of information from existing sources, selection and re-presentation in a form suitable to the intended purpose and audience. Includes instructional design, content development, configuration and testing of learning environments, and use of appropriate current technologies such as audio, video, simulation and assessment. May include third party accreditation.	Designs, creates, develops, customises and maintains learning materials and resources to deliver agreed outcomes, and meet accreditation requirements if appropriate. Assists with design, configuration and testing of learning environments, including creation of simulated data, and replication of external systems, interfaces and assessment systems.
Learning delivery	The transfer of business and/or technical skills and knowledge and the promotion of professional attitudes in order to facilitate learning and development. Uses a range of techniques, resources and media (which might include eLearning, on-line virtual environments, self-assessment, peer-assisted learning, simulation, and other current methods).	Prepares or customises and delivers learning activities to a variety of audiences.
Performance management	The optimisation of performance of people, including determination of capabilities, integration into teams, allocation of tasks, direction, support, guidance, motivation, and management of performance.	Supervises individuals and teams. Allocates routine tasks and/or project work. Provides direction, support and guidance as necessary, in line with individuals' skills and abilities. Monitors progress against agreed quality and performance criteria. Acts to facilitate effective working relationships between team members.

Skill	Description	
Resourcing	The overall resource management of the workforce to enable effective operation of the organisation. Provision of advice on any aspect of acquiring resources, including employees, consultants and contractors.	Implements resource plans, including conducting recruitment interviews. Facilitates selection, assessment and on-boarding processes, and internal resource allocation. Contributes to transitioning of resources, complying with relevant statutory or external regulations and codes of good practice.
Professional development	The facilitation of the professional development of individuals, including initiation, monitoring, review and validation of learning and development plans in line with organisational or business requirements. The counselling of participants in all relevant aspects of their continual professional development. The identification of appropriate learning/development resources. Liaison with internal and external training providers. The evaluation of the benefits of continual professional development activities.	Maintains skills framework, or information about access to standard frameworks. Advises on required outcomes for learning or development, from knowledge of skills frameworks and organisational development needs. Assists practitioners with the process of creating development plans based on outcome statements. Monitors practitioners' continuing professional development records, ensuring that achievements and enhanced capabilities are recorded and referenced to the outcome statements.
Quality management	The application of techniques for monitoring and improvement of quality to any aspect of a function or process. The achievement of, and maintenance of compliance to, national and international standards, as appropriate, and to internal policies, including those relating to sustainability and security.	Uses quality management models and techniques to identify areas for improvement. Determines corrective action to reduce errors and improve the quality of the system and services.
Quality assurance	The process of ensuring that the agreed quality standards within an organisation are adhered to and that best practice is promulgated throughout the organisation.	Investigates and documents the internal control of specified aspects of automated or partly automated processes, and assesses compliance with the relevant standard.



Skill	Description	
Quality standards	The development, maintenance, control and distribution of quality standards.	Controls, updates and distributes new and revised quality standards, including technical changes.
Conformance review	The independent assessment of the conformity of any activity, process, deliverable, product or service to the criteria of specified standards, best practice, or other documented requirements. May relate to, for example, asset management, Network Security tools, firewalls and internet security, sustainability, real-time systems, application design and specific certifications.	Conducts formal reviews of activities, processes, products or services. Collects, collates and examines records as part of specified testing strategies for evidence of compliance with management directives, or the identification of abnormal occurrences. Analyses evidence collated and drafts part or all of formal reports commenting on the conformance found to exist in the reviewed part of an information systems environment.
Digital forensics	The collection, processing, preserving, analysing, and presenting of computer-related evidence in support of security vulnerability mitigation and/or criminal, fraud, counterintelligence, or law enforcement investigations.	Contributes to digital Forensic Investigations. Processes and analyses computer evidence in line with policy, standards and guideline and supports production of forensics findings and reports.
Sourcing	The provision of policy, internal standards and advice on the procurement or commissioning of externally supplied and internally developed products and services. The provision of commercial governance, conformance to legislation and assurance of information security. The implementation of compliant procurement processes, taking full account of the issues and imperatives of both the commissioning and supplier sides. The identification and management of suppliers to ensure successful delivery of products and services required by the business.	Reviews business cases (requirements, potential benefits and options) and determines appropriate procurement routes, e.g., open market or collaborative framework. Using market knowledge to inform specifications, ensures detailed pre-qualification questionnaires and tender invitations are prepared. Collects and collates data to support collaboration and negotiates terms and conditions to reflect the scale of requirements and encourage good performance.

Skill	Description	
		Evaluates tenders based on specification and evaluation criteria, prepares acceptance documentation and advises on contracts and service level agreements. Monitors and reports on supplier performance, information security, customer satisfaction, and market intelligence. Investigates, resolves or escalates problems. Implements supplier service improvement actions and programmes.
Contract management	The overall management and control of the operation of formal contracts for supply of products and services.	Sources and collects contract performance data (such as pricing and supply chain costs), and monitors performance against KPIs. Identifies and reports under-performance and develops opportunities for improvement. Monitors compliance with Terms and Conditions and take appropriate steps to address non-compliance. Pro-actively manages risk and reward mechanisms in the contract. Monitors progress against business objectives specified in the business case. Identifies where change is required, and plans for variations. In consultation with stakeholders, ensures that change management protocols are implemented.

Skill	Description	
Relationship management	The identification, analysis, management and monitoring of relationships with and between stakeholders. (Stakeholders are individuals, groups, or organisations who may affect, be affected by, or perceive themselves to be affected by decisions, activities and outcomes related to products, services or changes to products and services.) The clarification of mutual needs and commitments through consultation and consideration of impacts. For example, the coordination of all promotional activities to one or more clients to achieve satisfaction for the client and an acceptable return for the supplier; assistance to the client to ensure that maximum benefit is gained from products and services supplied.	Implements stakeholder engagement/ communications plans, including, for example: handling of complaints; problems and issues; managing resolutions; corrective actions and lessons learned; collection and dissemination of relevant information. Uses feedback from customers and stakeholders to help measure effectiveness of stakeholder management. Helps develop and enhance customer and stakeholder relationships.
Customer service support	The management and operation of one or more customer service or service desk functions. Acting as a point of contact to support service users and customers reporting issues, requesting information, access, or other services.	Monitors customer service or service desk functions, and collects performance data. Assists with the specification, development, research and evaluation of services standards. Applies these standards to resolve or escalate issues and gives technical briefings to staff members.
Digital marketing	Integration of digital marketing with traditional print/broadcast methods, to support the research, analysis and stimulation of potential or existing markets for products and services, both to provide a sound basis for business development and to generate a satisfactory flow of sales enquiries. The management and development of strategies, campaigns and day-to-day marketing activity delivered through web and other appropriate digital channels and technologies.	Appraises factors that influence online marketing activity, carries out market research, and identifies unique selling points and key messages. Investigates and analyses customer and competitor dynamics and uses appropriate channels and technologies for target marketing and engagement.

Skill	Description	
		<p>Recognises and uses the similarities and differences between online and traditional marketing concepts and applications, providing advice on channel methodology, effectiveness and implementation. Makes creative use of elements relevant to both digital and traditional environments, and drafts appropriate support materials. Analyses the effectiveness of campaigns and services and their impact on audience behaviour and business outcomes. Organises and participates actively in marketing events.</p>
Selling	<p>The identification of sales prospects and their qualification, the development of customer interest and the preparation (including managing the bid process), execution and monitoring of the sale of any product or service into an external or internal market.</p>	<p>Collects and uses information in order to achieve sales objectives. Responds to existing sales leads and identifies and qualifies new leads and prospects with a view to developing a pipeline of potential opportunities. Understands customer and needs, and develops and enhances customer relationships, before, during and after the conclusion of agreements/contracts. Key tasks may also include bid management, value analysis, negotiation, presentation and preparation of contracts. Monitors and reports on quota, performance, customer satisfaction, market intelligence and competitors.</p>

Skill	Description	
Sales support	The provision of technical advice and assistance to the sales force, sales agents, reseller/distributor staff and existing or prospective customers, either in support of customer development or sales activity or in fulfilment of sales obligations.	Works closely with the sales team to help prospects to clarify their needs and requirements; devises solutions and assesses their feasibility and practicality. Demonstrates technical feasibility using physical or simulation models. Produces estimates of cost and risk and initial project plans to inform sales proposals. Resolves technical problems.
Product management	The active management of a product or service throughout its lifecycle (inception through to retirement) in order to address a market opportunity/customer need and generate the greatest possible value for the business.	Manages aspects of the product lifecycle, working with colleagues in other disciplines to enable effective marketing and customer support. May act as product owner for one or more lower value products or services. Facilitates product sales by planning development of marketing collateral content, supporting and evaluating campaigns, and monitoring product performance.

## Appendix 4: Mapping of Pearson BTEC HND in Computing against FHEQ Level 5

Key	
KU	Knowledge and Understanding
CS	Cognitive Skills
AS	Applied Skills
TS	Transferable Skills

The qualification will be awarded to students who have demonstrated:

FHEQ Level 5 descriptor		Computing HND Programme Outcome
Knowledge and critical understanding of the well-established principles of their area(s) of study, and of the way in which those principles have developed	KU1	Knowledge and understanding of the fundamental principles and practices of the contemporary global computing environment.
	KU2	Understanding and insight into different organisations, their diverse nature, purposes, structures and operations and their influence upon the external environment.
	KU3	A critical understanding of the evolving concepts, theories and models within the study of computing across a range of practical and hypothetical scenarios.
	KU4	An ability to evaluate and analyse a range of concepts, theories and models to make appropriate decisions.
	KU5	An appreciation of the concepts and principles of CPD, staff development, leadership and reflective practice as methods and strategies for personal and people development.
	KU6	Knowledge and understanding of vital concepts, principles and theories relating to computing and computer applications, software development, networking and media systems.

FHEQ Level 5 descriptor		Computing HND Programme Outcome
	KU7	Critical understanding of how computer-based technologies interrelate and communicate with one another, support processes and lead to a computerised solution to a problem.
	KU8	Understanding of the application of appropriate mathematical techniques in the design and development of software and computer systems.
	KU9	Critical understanding of the use of industry standard technical documentation and practices.
	KU10	Develop a range of multi-disciplined programming and coding skills.
	KU11	Deploy appropriate tools, theories, principles and methodologies to analyse, specify, construct, test and evaluate a computer based system in an appropriate context
	KU12	An ability to apply industry-standard methods in human-computer interaction to inform the development of usable interfaces.
Ability to apply underlying concepts and principles outside the context in which they were first studied, including, where appropriate, the application of those principles in an employment context	AS1	Evidence the ability to show client relationship management and develop appropriate policies and strategies to meet stakeholder expectations.
	AS2	Apply innovative ideas to develop and create new systems or services that respond to the changing nature of organisations.
	AS3	Integrate theory and practice through the investigation and examination of practices in the workplace.
	AS4	Develop outcomes for clients using appropriate practices and data to make justified recommendations.

FHEQ Level 5 descriptor		Computing HND Programme Outcome
	AS5	Apply IT concepts and principles to critically evaluate and analyse complex practical problems and provide IT based solutions.
	AS6	Effectively apply appropriate computer based technologies to analyse, develop and maintain reliable software.
	CS1	Deploy appropriate theory, practices and tools in order to analyse, specify, design and implement computing systems and software applications.
	CS2	Recognise and critically evaluate the professional, economic, social, environmental, moral and ethical issues that influence the sustainable exploitation of computerbased technologies.
	AS7	Employ a range of analytical techniques and design tools in the development of secure software.
Knowledge of the main methods of enquiry in the subject(s) relevant to the named award, and ability to evaluate critically the appropriateness of different approaches to solving problems in the field of study.	CS3	Critique a range of systems and operations and their application to maximise and successfully meet strategic objectives.
	KU13	An understanding of the appropriate techniques and methodologies used to resolve real-life problems in the workplace.
	TS1	Develop a skill set to enable the evaluation of appropriate actions taken for solving problems in a specific organisational context.
An understanding of the limits of their knowledge, and how this influences analysis and interpretations based on that knowledge.	TS2	Self-reflection, including self-awareness; the ability to become an effective self-student and appreciate the value of the self-reflection process.
	TS3	Undertake independent learning to expand on own skills and delivered content.



Typically, holders of the qualification will be able to:

FHEQ Level 5 descriptor		Computing HND Programme Outcomes
Use a range of established techniques to initiate and undertake critical analysis of information, and to propose solutions to problems arising from that analysis.	TS4	Competently use digital literacy to access a broad range of research sources, data and information.
	CS4	Interpret, analyse and evaluate a range of data, sources and information to inform evidence-based decision making.
	CS5	Synthesise knowledge and critically evaluate strategies and plans to understand the relationship between theory and real-world scenarios.
Effectively communicate information, arguments and analysis in a variety of forms to specialist and non-specialist audiences, and deploy key techniques of the discipline effectively.	TS5	Communicate confidently and effectively, both orally and in writing, both internally and externally with organisations and other stakeholders.
	TS6	Communicate ideas and arguments in an innovative manner using a range of digital media.
	AS8	Locate, receive and respond to a variety of information sources (e.g. textual, numerical, graphical and computer-based) in defined contexts.
	TS7	Communicate effectively, verbally and in writing and articulate well-defined issues, for a variety of purposes, taking into account the audience viewpoint
	TS8	Demonstrate strong interpersonal skills, including effective listening and oral communication skills, as well as the associated ability to persuade, present, pitch and negotiate.

FHEQ Level 5 descriptor		Computing HND Programme Outcome
Undertake further training, develop existing skills and acquire new competences that will enable them to assume significant responsibility within organisations	TS9	Identify personal and professional goals for continuing professional development in order to enhance competence to practise within a chosen computing field.
	TS10	Take advantage of available pathways for continuing professional development through higher education, Professional Body Qualifications and Vendor Accredited Certifications.

Holders will also have:

FHEQ Level 5 descriptor		Computing HND Programme Outcomes
The qualities and transferable skills necessary for employment requiring the exercise of personal responsibility and decision-making.	TS11	Develop a range of skills to ensure effective team working, independent initiatives, organisational competence and problem-solving strategies.
	TS12	Show an ability to work as a member of a development team, recognising the different roles within a team and the different ways of organising teams
	TS13	Reflect adaptability and flexibility in approach to work; showing resilience under pressure and meeting challenging targets within given deadlines.
	TS14	Use quantitative skills to manipulate data, evaluate and verify existing theory.
	TS15	Show awareness of current developments within the computing industry and their impact on employability and CPD.
	TS16	Manage small to medium scale projects using appropriate planning and time management techniques.
	CS6	Evaluate the changing needs of the business environment and have confidence to self-evaluate and undertake additional CPD as necessary.
	TS17	Display emotional intelligence and sensitivity to diversity in relation to people and cultures.

## Appendix 5: Glossary of terms used for internally assessed units

This is a summary of the key terms used to define the requirements within units.

Term	Definition
Analyse	<p>Present the outcome of methodical and detailed examination either:</p> <ul style="list-style-type: none"> <li>breaking down a theme, topic or situation in order to interpret and study the interrelationships between the parts and/or of information or data to interpret and study key trends and interrelationships.</li> </ul> <p>Analysis can be through activity, practice, written or verbal presentation.</p>
Apply	<p>Put into operation or use.</p> <p>Use relevant skills/knowledge/understanding appropriate to context.</p>
Arrange	Organise or make plans.
Assess	Offer a reasoned judgement of the standard/quality of a situation or a skill informed by relevant facts.
Calculate	Generate a numerical answer with workings shown.
Compare	<p>Identify the main factors relating to two or more items/situations or aspects of a subject that is extended to explain the similarities, differences, advantages and disadvantages.</p> <p>This is used to show depth of knowledge through selection of characteristics.</p>
Compose	Create or make up or form.
Communicate	<p>Convey ideas or information to others.</p> <p>Create/construct skills to make or do something, for example a display or set of accounts.</p>
Create/Construct	Skills to make or do something, for example a display or set of accounts.
Critically analyse	Separate information into components and identify characteristics with depth to the justification.
Critically evaluate	Make a judgement taking into account different factors and using available knowledge/experience/evidence where the judgement is supported in depth.
Define	State the nature, scope or meaning.
Describe	Give an account, including all the relevant characteristics, qualities and events.

Term	Definition
Discuss	Consider different aspects of: <ul style="list-style-type: none"> <li>• a theme or topic; how they interrelate; and the extent to which they are important.</li> </ul>
Demonstrate	Show knowledge and understanding.
Design	Plan and present ideas to show the layout/function/workings/object/system/process.
Develop	Grow or progress a plan, ideas, skills and understanding
Differentiate	Recognise or determine what makes something different.
Discuss	Give an account that addresses a range of ideas and arguments
Evaluate	<p>Work draws on varied information, themes or concepts to consider aspects, such as:</p> <ul style="list-style-type: none"> <li>• strengths or weaknesses</li> <li>• advantages or disadvantages</li> <li>• alternative actions</li> <li>• relevance or significance</li> </ul> <p>Students' inquiries should lead to a supported judgement showing relationship to its context. This will often be in a conclusion. Evidence will often be written but could be through presentation or activity.</p>
Explain	To give an account of the purposes or reasons.
Explore	Skills and/or knowledge involving practical research or testing.
Identify	Indicate the main features or purpose of something by recognising it and/or being able to discern and understand facts or qualities.
Illustrate	Make clear by using examples or provide diagrams.
Indicate	Point out, show.
Interpret	State the meaning, purpose or qualities of something through the use of images, words or other expression.
Investigate	Conduct an inquiry or study into something to discover and examine facts and information.
Justify	<p>Students give reasons or evidence to:</p> <ul style="list-style-type: none"> <li>• support an opinion; or prove something right or reasonable.</li> </ul>
Outline	Set out the main points/characteristics.
Plan	Consider, set out and communicate what is to be done.
Produce	To bring into existence.
Reconstruct	To assemble again/reorganise/form an impression.

Term	Definition
Report	Adhere to protocols, codes and conventions where, findings or judgements are set down in an objective way.
Review	Make a formal assessment of work produced. The assessment allows students to: <ul style="list-style-type: none"> <li>• appraise existing information or prior events reconsider information with the intention of making changes, if necessary.</li> </ul>
Show how	Demonstrate the application of certain methods/theories/concepts.
Stage & Manage	Organisation and management skills, for example running an event or a business pitch.
State	Express
Suggest	Give possible alternatives, produce an idea, put forward, e.g. an idea or plan, for consideration
Undertake/ Carry Out	Undertake/carry out. Use a range of skills to perform a task, research or activity.

This is a key summary of the types of evidence used for Pearson BTEC Higher Nationals:

Type of evidence	Definition
Case study	A specific example to which all students must select and apply knowledge.
Project	A large scale activity requiring self-direction of selection of outcome, planning, research, exploration, outcome and review.
Independent research	An analysis of substantive research organised by the student from secondary sources and, if applicable, primary sources.
Written task or report	Individual completion of a task in a work-related format, e.g. a report, marketing communication, set of instructions, giving information.
Simulated activity/ role play	A multi-faceted activity mimicking realistic work situations.
Team task	Students work together to show skills in defining and structuring activity as a team.
Presentation	Oral or through demonstration.
Production of plan/business plan	Students produce a plan as an outcome related to a given or limited task.

Type of evidence	Definition
Reflective journal	Completion of a journal from work experience, detailing skills acquired for employability.
Poster/leaflet	Documents providing well-presented information for a given purpose.

## Appendix 6: Assessment methods and techniques for Pearson BTEC Higher Nationals

Assessment technique	Description	Transferable skills development	Formative or Summative
Academic graphic display	This technique asks students to create documents providing well-presented information for a given purpose. Could be a hard or soft copy.	Creativity Written Communication Information and Communications Technology Literacy	Formative Summative
Case study	This technique present students with a specific example to which they must select and apply knowledge.	Reasoning Critical thinking Analysis	Formative Summative
Discussion forum	This technique allows students to express their understanding and perceptions about topics and questions presented in the class or digitally, for example, online groups, blogs.	Oral/written communication Appreciation of diversity Critical thinking and reasoning Argumentation	Formative
Independent research	This technique is an analysis of research organised by the student from secondary sources and, if applicable, primary sources.	Information and communications technology Literacy Analysis	Formative



Assessment technique	Description	Transferable skills development	Formative or Summative
Oral/Viva	This technique asks students to display their knowledge of the subject via questioning.	Oral communication Critical thinking Reasoning	Summative
Peer-review	This technique asks students to provide feedback on each other's performance. This feedback can be collated for development purposes.	Teamwork Collaboration Negotiation	Formative Summative
Presentation	This technique asks students to deliver a project orally or through demonstration.	Oral communication Critical thinking Reasoning Creativity	Formative Summative
Production of an artefact/ performance or portfolio	This technique requires students to demonstrate that they have mastered skills and competencies by producing something. Some examples are Computing plans, using a piece of equipment or a technique, building models, developing, interpreting, and using maps.	Creativity Interpretation Written and oral communication Interpretation Decision-making Initiative Information and Communications Technology Literacy, etc	Summative

Assessment technique	Description	Transferable skills development	Formative or Summative
Project	This technique is a large scale activity requiring self-direction, planning, research, exploration, outcome and review.	Written communication Information Literacy Creativity Initiative	Summative
Role playing	This technique is a type of case study, in which there is an explicit situation established, with students playing specific roles, understanding what they would say or do in that situation.	Written and oral communication Leadership Information literacy Creativity Initiative	Formative
Self-reflection	This technique asks students to reflect on their performance, for example, to write statements of their personal goals for the course at the beginning of the course, what they have learned at the end of the course and their assessment of their performance and contribution; completion of a reflective journal from work experience, detailing skills acquired for employability.	Self-reflection Written communication Initiative Decision-making Critical thinking	Summative

Assessment technique	Description	Transferable skills development	Formative or Summative
Simulated activity	This technique is a multi-faceted activity based on realistic work situations.	Self-reflection Written communication Initiative Decision-making Critical thinking	Formative Summative
Team assessment	This technique asks students to work together to show skills in defining and structuring an activity as a team.  All team assessment should be distributed equally, each of the group members performing their role, and then the team collates the outcomes, and submits it as a single piece of work.	Collaboration Teamwork  Leadership Negotiation Written and oral communication	Formative Summative
Tiered knowledge	This technique encourages students to identify their gaps in knowledge. Students record the main points they have captured well and those they did not understand.	Critical thinking Analysis Interpretation Decision-making Oral and written communication	Formative

Assessment technique	Description	Transferable skills development	Formative or Summative
Time-constrained assessment	This technique covers all assessment that needs to be done within a centre-specified time-constrained period on-site.	Reasoning Analysis Written communication Critical thinking Interpretation	Summative
Top ten	This technique asks students to create a 'top ten' list of key concepts presented in the assigned reading list.	Teamwork Creativity Analysis Collaboration	Formative
Written task or report	This technique asks students to complete an assignment in a structured written format, for example, a Computing plan, a report, marketing communication, set of instructions, giving information.	Reasoning Analysis Written communication Critical thinking, interpretation.	Summative

## Appendix 7: Pearson BTEC HNC/HND Computing Programme Outcomes for Students

	Knowledge and Understanding													Cognitive skills						Applied skills								Transferable skills																		
Unit	1	2	3	4	5	6	7	8	9	10	11	12	13	1	2	3	4	5	6	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17		
1	X		X	X		X	X	X	X	X	X	X		X		X		X			X		X	X	X	X		X	X	X	X	X	X	X		X	X	X	X	X		X	X			
2	X	X	X	X		X	X		X		X			X		X		X			X		X	X	X			X	X	X	X	X	X	X	X		X	X	X	X	X		X	X		
3	X	X	X	X	X	X			X		X		X		X	X		X	X	X		X							X	X	X	X	X	X	X	X	X		X	X	X			X	X	X
4	X	X	X	X		X	X		X	X	X	X	X	X			X	X	X	X			X	X	X	X		X	X	X	X	X	X	X	X		X	X	X	X	X		X	X		
5	X		X			X			X						X	X		X			X		X	X	X				X	X	X	X	X	X	X		X	X	X		X		X			
6	X	X	X	X	X	X	X		X		X	X	X	X	X	X	X	X	X	X	X		X	X	X		X		X	X	X	X	X	X	X	X	X		X	X	X		X	X	X	
7	X	X	X	X		X	X		X	X	X			X		X		X	X	X	X		X		X	X		X	X	X	X	X	X	X	X		X		X	X	X	X	X			
8	X		X			X	X		X	X	X	X		X		X		X			X	X		X	X			X	X	X	X	X	X	X	X		X	X	X	X	X		X	X		
9	X		X	X	X	X	X		X				X	X		X		X			X	X		X	X	X		X	X	X	X	X	X	X		X		X	X	X		X	X			
10	X	X	X	X		X	X		X	X	X	X		X	X	X		X			X		X	X	X	X		X	X	X	X	X	X	X		X		X	X	X		X	X	X		
11				X		X		X	X									X								X	X	X	X	X						X		X		X	X	X				
12	X		X	X		X	X	X	X		X			X		X	X	X	X			X		X	X	X	X	X	X	X	X	X	X	X		X		X		X	X	X				
13	X	X	X	X	X	X	X		X		X		X	X	X	X	X	X	X	X	X		X				X		X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	
14	X	X	X	X	X	X			X				X		X		X	X	X	X	X	X	X	X			X		X	X	X	X	X	X	X	X	X		X	X	X		X	X	X	
15	X		X			X	X		X		X			X		X		X			X		X	X	X			X	X	X	X	X	X	X	X		X	X	X	X	X		X	X		
16	X		X			X	X		X	X	X			X		X		X			X		X	X	X	X		X	X	X	X	X	X	X		X	X	X	X	X		X	X			
17	X		X	X		X	X		X		X			X		X		X			X	X		X	X	X			X	X	X	X	X	X	X		X		X	X	X		X	X		
18				X		X		X	X									X								X	X	X	X	X						X		X		X	X	X				
19	X		X	X		X		X	X		X			X		X		X			X		X	X	X	X		X	X	X	X	X	X	X		X		X	X	X		X	X			
20	X		X	X		X	X	X	X	X	X	X		X		X		X			X		X	X	X	X		X	X	X	X	X	X	X		X	X	X	X	X		X	X			
21	X	X	X	X		X		X	X	X	X			X		X	X	X	X			X		X	X	X	X	X	X	X	X	X	X	X		X	X	X		X		X				
22	X		X	X		X		X	X		X			X		X		X			X		X	X	X	X		X	X	X	X	X	X	X		X	X	X	X	X	X	X	X			
23	X	X	X	X		X		X	X									X			X		X	X	X			X	X	X	X	X	X	X		X		X		X	X	X	X			

	Knowledge and Understanding													Cognitive skills						Applied skills								Transferable skills																		
Unit	1	2	3	4	5	6	7	8	9	10	11	12	13	1	2	3	4	5	6	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17		
24	X	X	X	X		X			X		X							X			X		X	X	X			X	X	X	X	X	X	X		X		X		X		X	X			
25	X	X	X	X		X			X		X			X	X	X	X	X		X	X		X	X	X	X		X	X	X	X	X	X	X		X		X		X		X	X	X		
26	X		X			X	X		X	X	X			X		X		X			X		X	X	X	X		X	X	X	X	X	X	X		X		X	X	X		X	X			
27	X		X			X			X		X			X		X		X			X		X	X	X	X		X	X	X	X	X	X	X		X		X	X	X		X	X	X		
28	X		X	X		X	X		X	X	X	X		X		X		X		X	X		X	X	X	X		X	X	X	X	X	X	X		X		X	X	X		X	X			
29	X		X			X			X		X			X		X		X			X		X	X	X	X		X	X	X	X	X	X	X		X		X	X	X		X	X			
30	X	X	X	X		X	X		X	X	X	X		X		X		X			X		X	X	X	X		X	X	X	X	X	X	X		X	X	X	X	X		X	X			
31	X		X	X		X	X		X		X			X		X		X			X		X	X	X	X		X	X	X	X	X	X	X		X		X	X	X		X	X			
32	X		X	X		X	X		X	X	X	X		X	X	X		X		X	X		X	X	X	X		X	X	X	X	X	X	X		X		X	X	X		X	X	X		
33				X		X		X	X									X								X	X	X	X	X					X	X	X		X	X	X		X			
34	X	X	X	X	X	X			X		X		X	X		X	X	X	X			X		X	X	X	X	X	X	X	X	X	X	X		X		X	X	X		X	X			
35	X	X	X	X		X			X		X			X		X		X			X		X	X	X			X	X	X	X	X	X	X		X		X	X	X		X	X			
36	X		X			X	X		X	X	X			X		X		X			X		X	X	X			X	X	X	X	X	X	X		X		X	X	X		X	X			
37	X		X			X			X		X			X		X		X			X		X	X	X			X	X	X	X	X	X	X		X		X	X	X		X	X			
38	X	X	X	X		X	X		X	X	X	X		X		X		X			X		X	X	X	X		X	X	X	X	X	X	X		X		X	X	X		X	X			
39	X	X	X	X	X	X			X						X			X	X					X	X	X				X	X	X	X	X	X		X		X		X		X	X		
40	X	X	X	X		X	X		X	X	X	X		X		X		X		X	X		X	X	X	X		X	X	X	X	X	X	X		X	X	X	X	X		X	X	X		
41	X		X			X		X	X	X	X			X		X		X			X		X	X	X			X	X	X	X	X	X	X		X		X	X	X		X	X			
42	X	X	X	X		X			X		X		X	X	X	X	X	X					X	X	X		X	X	X	X	X	X	X	X		X		X	X	X	X	X		X	X	
43	X	X	X			X			X	X	X			X	X	X		X		X	X		X	X	X	X	X	X	X	X	X	X	X	X		X		X	X	X		X	X			
44	X		X	X		X	X		X	X	X			X	X	X		X			X		X	X	X			X	X	X	X	X	X	X		X		X	X	X		X	X			
45	X	X	X		X	X			X		X				X	X	X	X	X	X									X	X	X	X	X	X		X		X		X		X	X			
46	X		X	X		X	X		X	X	X	X		X	X	X		X			X		X	X	X	X		X	X	X	X	X	X	X		X		X	X	X		X	X			
47	X		X	X		X	X		X	X	X	X		X	X	X		X			X		X	X	X	X		X	X	X	X	X	X	X		X		X	X	X		X	X	X		

	Knowledge and Understanding													Cognitive skills						Applied skills								Transferable skills																
Unit	1	2	3	4	5	6	7	8	9	10	11	12	13	1	2	3	4	5	6	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
48	X	X	X			X			X		X			X	X	X		X		X	X		X	X	X			X	X	X	X	X	X	X		X	X	X	X	X		X	X	
49	X		X			X	X		X	X	X			X		X		X			X		X	X	X			X	X	X	X	X	X	X		X	X	X	X	X		X	X	

## Appendix 8: Transferable skills mapping

### Level 5 Higher National Diploma in Computing: mapping of transferable employability and academic study skills

Skill Set	Cognitive skills							Intra-personal Skills				Interpersonal Skills			
Unit	Problem Solving	Critical Thinking/Analysis	Decision Making	Effective Communication	Digital Literacy	Numeracy	Creativity	Plan Prioritise	Self-Management	Independent learning	Self-Reflection	Team Work	Leadership	Cultural Awareness	Interpersonal Skills
1	X	X	X		X		X	X	X		X				
2	X	X	X		X		X	X	X	X	X			X	
3		X	X	X			X	X	X	X	X	X	X	X	X
4	X	X	X		X	X	X	X	X	X	X				
5	X	X	X		X			X	X	X	X				
6	X	X	X	X	X		X	X	X	X	X	X	X	X	X
7	X	X	X		X	X		X	X	X	X				
8	X	X	X	X	X	X	X	X	X	X	X				
9	X	X	X	X	X	X	X	X	X	X	X	X	X		X
10	X	X	X	X	X		X	X	X	X	X		X		
11	X	X	X			X		X	X	X					
12	X	X	X		X	X		X	X	X	X				
13	X	X	X	X	X		X	X	X	X	X		X		X
14		X	X	X	X		X	X		X	X			X	
15	X	X	X	X	X	X	X	X	X	X	X				
16	X	X	X	X	X	X	X	X	X	X	X				
17	X	X	X	X	X			X	X	X	X		X	X	



Skill Set	Cognitive skills							Intra-personal Skills				Interpersonal Skills			
18	X	X	X			X		X	X	X	X				
19	X	X	X	X	X	X	X	X	X	X	X		X		
20	X	X	X		X	X	X	X	X	X	X				
21	X	X	X			X	X	X	X	X	X				
22	X	X	X	X	X	X	X	X	X		X				
23		X		X	X	X			X	X	X			X	
24	X	X	X		X	X	X	X	X	X	X			X	
25	X	X	X	X	X			X	X	X	X		X	X	X
26	X	X	X	X	X	X	X	X	X	X	X				
27	X	X	X	X	X	X	X	X	X	X	X		X		
28	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
29	X	X	X	X	X		X	X	X	X	X	X	X	X	X
30	X	X	X	X	X	X	X	X	X	X	X		X		
31	X	X	X	X	X		X	X	X	X	X	X	X	X	X
32	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
33	X	X	X		X	X	X	X	X	X	X				
34	X	X	X	X	X		X	X	X	X	X	X	X	X	X
35	X	X	X	X	X			X	X	X	X				
36	X	X	X	X	X		X	X	X	X	X				
37	X	X	X	X	X		X	X	X	X	X				
38	X	X	X	X	X		X	X	X	X	X	X	X		X
39	X	X	X	X	X		X	X	X	X	X	X	X	X	X
40	X	X	X	X	X		X	X	X	X	X	X	X	X	X

Skill Set	Cognitive skills							Intra-personal Skills				Interpersonal Skills			
41	X	X	X	X	X		X	X	X	X	X	X			X
42	X	X	X	X	X			X	X	X	X		X		X
43	X	X	X	X	X		X	X	X	X	X		X	X	
44	X	X	X	X	X	X	X	X	X	X	X				
45		X	X	X	X				X	X	X			X	
46	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
47	X	X	X	X	X		X	X	X	X	X	X	X	X	X
48	X	X	X		X			X	X	X	X				
49	X	X	X		X		X	X	X	X	X	X	X		X

March 2017

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# Programme Handbook

January  
2019

School of Computing  
BSc (Hons) Computing (IMC)



INVESTORS  
IN PEOPLE

Silver

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## Welcome from Programme Leader

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As your Edinburgh Napier Programme Leader for BSc (Hons) Computing (IMC), on behalf of the staff members of the School of Computing and the Programme Team, we would like to extend a very warm welcome to the university. We look forward to working with IMC and you and supporting you during your time at Edinburgh Napier University. We hope you will have a fantastic time and make the most of all the opportunities that are available to you.

The Programme Team hope that you will have an enjoyable, interesting and challenging year of researching and learning which will provide a sound basis for the future.

Just a couple of quick reminders:

- **You must matriculate to the programme.** In this programme, you will be manually matriculated by staff at Edinburgh Napier based on data supplied by IMC. Please read all emails about this you may receive, and discuss with your IMC programme team if it appears this process has gone wrong.
- You will receive a student card from Edinburgh Napier and you will receive a username and password which provides access to all our online systems like e-mail, Moodle, online library resources, VSOC and others.
- **Personal Information:** It is your responsibility to notify the University promptly of any change of address, change of name or changes to your personal information. This can be done via eStudent Records on myNapier.
- **In case of emergencies:** Please follow IMC guidelines on emergencies.
- The purpose of this handbook is to give you a permanent source of information about your programme and to make you aware of some of the more important regulations under which it operates. Members of the teaching staff will be happy to explain any aspects which might seem unclear. Please ensure you know where to find a copy of it for future reference, and read its contents carefully.

## 2

**About your programme of study and the School of Computing****2.1** *Programme Team*

Your programme has a team to manage its day-to-day running. If you have a question or problem, then you should contact one of the following members of staff. You should ensure that you know who the members of the Programme Team are for your programme.

**Edinburgh Napier Programme Leader**

Dr Petra Leimich      [p.leimich@napier.ac.uk](mailto:p.leimich@napier.ac.uk)

The role of your Edinburgh Napier Programme leader is to manage and co-ordinate the operation of your programme on behalf of Edinburgh Napier University.

**IMC Programme Leader**

Dr May Thu Aung      [dr-maythuaung@imcscompany.com](mailto:dr-maythuaung@imcscompany.com)

Your IMC Programme Leader will manage and co-ordinate the programme on behalf of IMC. This is the person to whom you should go in the first instance for guidance on any academic or personal issues that may affecting your academic work. If you feel they have not addressed the issue effectively, you should then contact your Edinburgh Napier Programme leader.

**Module Leaders**

Dr Petra Leimich      [p.Leimich@napier.ac.uk](mailto:p.Leimich@napier.ac.uk)

Andrew Cumming      [a.Cumming@napier.ac.uk](mailto:a.Cumming@napier.ac.uk)

Dr Gordon Russell	<a href="mailto:g.russell@napier.ac.uk">g.russell@napier.ac.uk</a>
Robert Ludwiniak	<a href="mailto:r.Ludwiniak@napier.ac.uk">r.Ludwiniak@napier.ac.uk</a>
Jim Jackson	<a href="mailto:J.jackson@napier.ac.uk">J.jackson@napier.ac.uk</a>
Naghmeh Moradpoor	<a href="mailto:N.moradpoor@napier.ac.uk">N.moradpoor@napier.ac.uk</a>
Alison Varey	<a href="mailto:A.Varey@napier.ac.uk">A.Varey@napier.ac.uk</a>
Peter Cruickshank	<a href="mailto:p.cruikshank@napier.ac.uk">p.cruikshank@napier.ac.uk</a>
Brian Davison	<a href="mailto:B.Davison@napier.ac.uk">B.Davison@napier.ac.uk</a>
Taoxin Peng	<a href="mailto:t.peng@napier.ac.uk">t.peng@napier.ac.uk</a>
Kevin Chalmers	<a href="mailto:k.Chalmers@napier.ac.uk">k.Chalmers@napier.ac.uk</a>

Module leaders are responsible for organising and running the modules that constitute your programme. IMC will provide lecturers to help you with your daily studies.

### Disability and Inclusion Contacts

Edinburgh Napier and IMC offer a wide range of support services to students with disabilities or inclusion needs. Your first point of contact to access these services should be your IMC Programme Leader. If you need further help, you should contact your Edinburgh Napier Programme Leader.

## 2.2 *Communication between you and your Programme Team*

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### Email

As a matriculated student of the University you will be allocated a University email address. This is the **only** recognised account for emailing your Programme Team, your administrative team or the University's support services. Your University email is also linked to Moodle. This will mean that you will receive any notifications from Moodle direct to your email account. Accessing your email regularly helps to keep you connected to the University. You can do this from any Internet enabled device, including tablets and smart phones.

 **It is your responsibility to check your Edinburgh Napier e-mail account regularly**

### Moodle

Moodle is the online learning environment for supporting your studies at the University. It provides secure access to important course information, learning activities and additional learning support where appropriate. Once you have matriculated you will automatically be registered in Moodle and enrolled to the module sites. Please take the time to find how Moodle is to be used within your modules and take advantage of the opportunities provided. You can login to Moodle from



any Internet enabled device, including tablets and smart phones. Support for Moodle is available from IMC and Edinburgh Napier Programme Leader.



**It is your responsibility to check the programme Moodle pages regularly.**

### **Information through social media**

Your programme may make use of social media such as Facebook and Twitter to create additional online spaces for communication with the Programme Team, fellow students, and associates outwith the University. The University recognises the potential benefits of social media, and encourages responsible and acceptable use so that you can enjoy the benefits of online networks, whilst maintaining the high standards of conduct expected by the University and relevant professional organisations. Guidance of how to be webwise can be found in the Data Protection section on myNapier.



**It is your responsibility to maintain a professional online identity when using social media.**

### **How we will communicate last minute changes to activities**

Although we like to avoid changes, sometimes they are unavoidable. Any last minute changes to your delivery will be communicated to you by your IMC tutors, or by email.

### 3 Important dates for your diary!

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#### 3.1 *Examination Dates*

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Unlike other University programmes, there will be no periods dedicated for exams only. References to “Exam Dates” on myNapier and elsewhere can be ignored as they refer to other programmes.

#### 3.2 *Induction Activities*

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Edinburgh Napier is committed to ensuring that you have a great induction experience as you join the learning community of the university. Induction activities are delivered by your Programme Team and IMC. This week will give you the opportunity to meet your programme leader (or depute) and members of the teaching team, get to know students in your programme and to engage in a range of social events. It's a great way to get to know people!

#### 3.3 *Attendance expectations*

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To get the most from your time on your programme, it is critical that you attend all scheduled class activities. There is clear evidence that links attendance to successful progression and keeping our students through the programme. If you cannot attend classes due to personal problems or illness, please ensure that you don't miss out by studying the related material on Moodle and by asking your tutors for guidance.

Classes are scheduled every day 09:00am to 15:00pm.

## 4

**So, what will my programme be like?****4.1 Background**

The BSc (Hons) Computing (IMC) is specifically designed to give you the right professional skills that you will find useful in the digital economy of Myanmar. The programme is based on the BSc (Hons) Computing that Edinburgh Napier is delivering on-campus and will start in August 2018.

Edinburgh Napier University aspires to deliver education to the international stage. This partnership with Info Myanmar College (IMC) allows us to deliver the course in Yangon with no compromises in quality. We will be using our own staff extensively and in a manner that delivers the same experience our students get in Scotland. The course material is the same as the material we use in other courses and the course has been designed with academic rigour equal to any other course.

Edinburgh Napier has strong reputation teaching practical skills and make our graduates employable. In your area, we are particularly known for our strengths in Cyber Security, Computer Science as well as for our connection with the industry.

This course should provide you with the knowledge to support your careers, both now and into the future, both by developing your skills to reflect the issues of today, but also by developing your personal skills to support your continual personal development into the future. It will also prepare you for a range of Masters programmes throughout the world.

## 4.2 *Philosophy*

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The philosophy of the Programme is to use a vocational approach with a high degree of practical application to create high employability. You will be encouraged to take an independent self-learning approach to developing a deep knowledge of the subject area.

This course focuses on Software Development or Networking with Cyber Security. These give graduates a solid foundation in the complete understanding of the design, implementation, evaluation and maintenance of complex systems, from application programs, to the transmission of data over the networks. Along with this, the coverage of key principles, such as encryption/authentication, networking and software development will give you a range of relevant skills, and enable you to undertake a wide range of roles. The course, is a full-time activity.

### 4.2.1 **Programme Aims and Learning Outcomes**

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The course provides both relevant fundamental knowledge, such as cryptography but also provides relevant practical examples through lab-based practice, and emphasises engineering practice.

#### **Programme General Aims**

The general aims of this course are to:

- to provide the knowledge of the concepts, principles and practice for the discipline areas of Networking and Software Development;
- to develop your understanding and awareness of theory and practice in your chosen area of computing;
- to stimulate an enquiring, creative, and reflective approach that encourages independent judgement and critical awareness ;
- to provide you with transferable skills, such as oral and written communication, time management and group working, to assist you in subsequent employment or further study;
- to ensure that you have the basis for both future personal development and for continuing professional development.

#### **Programme Learning Outcomes**

Learning outcomes describe what you should know and be able to do if you take full advantage of the learning opportunities we provide. This programme will provide you with opportunities to develop and demonstrate your knowledge and understanding of computing and to develop your practical, critical and analytical skills and attributes. On completion of this programme you will have:

**A: Knowledge and understanding of:**

- A1. a critical understanding of the analysis, design, development, testing, evaluation and modification of reliable and maintainable software, including web-based software;
- A2. a critical understanding of integrating security into computer systems from a hardware and software point of view including networking, Web integration, systems integration, and wireless systems;
- A3. the gathering, storage, retrieval and analysis of information in a variety of contexts;
- A4. a critical understanding of the operation and implementation of distributed and networked systems;
- A5. a critical understanding of the scope of computer and network architectures from a hardware and software point of view;
- A6. a critical understanding of the human, social, organisational, economic, legal and technological factors which affect, and are affected by computer-based systems.

**B: Skills and other attributes which will enable you to:**

- B1. critically apply appropriate theory, practice, professional standards and creativity to the analysis, design, development, testing, evaluation and modification of reliable and maintainable software, including mobile and distributed systems;
- B2. work individually and with others to develop and critically evaluate solutions to open-ended and complex problems;
- B3. plan, conduct, report on and critically evaluate a project of individual research;
- B4. demonstrate independent and creative thought by applying the skills needed for academic study and enquiry, such as, selecting and synthesising relevant information from a number of sources and critically evaluating research and evidence;
- B5. communicate effectively orally, in writing and diagrammatically;
- B6. learn independently, reflect critically on his/her own academic, professional and technical performance and appreciate the need for continuing professional development.



#### 4.2.2 What approaches to teaching and learning are used on my programme?

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This course offers students a full-time, 9-3, 5 days per week immersive academic programme. The timetabled face to face portions greatly exceed the normal time allocations found in traditional degree modules. This extra time will be used to increase the richness of the educational experience, providing opportunities for more hands-on activities, group exercises, peer support, and an overall increased contact time for student support. However some of this time you will be expected to learn independently.

Modules will be run either by Edinburgh Napier or IMC under the guidance of an Edinburgh Napier module leader.

For the purposes of scheduling and execution, each module group should be considered to run over a 5 week.

##### **Programme delivery**

The course is delivered on a full-time basis at IMC. You study a number of modules over the year. Each module is worth 20 SCQF credits except the Honours Project which is 40 credits. If you pass all the modules, you will be eligible for an Honours Degree.

##### **Additional Guidance**

Your presentation model mixes the concepts of lectures, tutorials, workshops, practical activities, and independent study time.

##### **Lectures**

When a lecturer presents information to you in a lecture, then this is an opportunity for a lecturer to communicate information to a large group of students. Most material will be available on **Moodle, so it is important you are familiar with the system and register for modules**. Taking additional notes during lectures is an important aspect of learning as you will find well-structured summaries of the lectures a valuable starting point for investigating a topic in the library and elsewhere such as the Web. If you wish to ask a question please do so. However you will find that some lecturers prefer to take individual questions at the end of the class in order to minimise disruption to the class as a whole.

##### **Tutorials**

These may be used for discussion of topics covered in the module, or for discussion based on problem-solving questions. You may be asked to prepare a paper to read aloud at a tutorial or you may be asked to make a presentation to the tutorial, either individually or as part of a group.

##### **Laboratories**

Laboratories give you the opportunity to develop computer skills. You will be expected to work at your own pace using self-teaching packages

and a subject tutor will be available to assist with individual problems. It is important to remember that the timetabled class hours are only a part of the hours which you will need to spend on developing computer skills. You should schedule time for regular independent work during lab days each week.

### Independent and Directed Study

You will have time for individual study i.e. researching, reading, preparing material for tutorials, referring to texts and articles, preparing coursework assignments, revising for tests etc. You should generally do this during the teaching periods that you are not receiving direct delivery from a tutor or lecturer. Every module will schedule such periods, although these will mostly be reserved for the later weeks of the module.

#### 4.2.3 What will assessment and feedback be like on my programme of study?

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As part of your programme of study you will experience a variety of assessments. These help both you and your module leaders gauge how you are getting on with the modules in your programme. These assessments may take a wide range of forms. These may be coursework or examination based or both. These assignments may also be formative (to allow you to test your understanding and get feedback to support your further development and understanding of the subject matter) or may be summative (where the assessment will count towards the final mark for the module).

During each module you should receive an **assessment brief**. This will detail your module, who is responsible for setting the assessment, a description of the assessment, percentage weighting, and information on size and or time limits. You should also be advised on when and where the assessment should be submitted.

Details of all the assessments that you are required to undertake on each module during the trimester can be found in the Moodle information for each module. This should tell you the type of assessment, the week the work is required to be submitted, when you can expect to get feedback, and the method that will be used to give you the feedback. Note each group may have a different assessment schedule.

Note that coursework deadlines are hard deadlines, and failure to submit to a deadline can result in a mark of 0%. Other assessments may occur on a fixed schedule, and similarly failure to take the assessment according to the schedule may result in 0%.

#### 4.2.4 How do I progress through programme, developing my subject expertise?

In the modules, the course is filling in your background knowledge, which is essential in supporting the subsequent modules of the course. It also provides key knowledge which is applicable immediately for relevant employment activities. This will cover computer hardware, operating systems, Linux, scripting and advanced web technologies.

In the second part, all students will get a very deep understanding of Linux and how it can be used to deliver services and wireless networks. Students coming from a Software Engineering background will then engage in a Group Project lead by IMC in collaboration with industry partners. Students coming from a Networking background will learn principles of Cyber Security, including Malware Analysis, Firewalls, Network Monitoring and Cryptography.

#### 4.2.5 In addition to the developing my subject knowledge and expertise, what other opportunities are available on my programme?

Edinburgh Napier has a particular interest in ensuring your employability and transferrable skills are developed over the course of the programme. Mixed into the modules are activities and assessments designed to not only develop key technical skills, but to also enhance other skills. You may be asked to make presentations, engage in group activities, perform peer assessment, and engage in discussions. These should considerably enhance your employability, as well as improving confidence.

Graduates of the course are welcome to further their education and to obtain higher degrees from Edinburgh Napier or elsewhere globally.

#### 4.2.6 Programme Structures

##### BSc Computing – Networking route

<b>CSN08601</b> Computer Systems	<b>CSN08614</b> Scripting for Cyber Security and Networks	<b>SET09603</b> Advanced Web Technologies	<b>CSN09603</b> Networked Services	<b>CSN09604</b> Wireless Local Area Network	<b>CSN09612</b> Network Security and Cryptography
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##### BSc Computing – Software Development route

<b>CSN08601</b> Computer Systems	<b>CSN08614</b> Scripting for Cyber Security and Networks	<b>SET09603</b> Advanced Web Technologies	<b>CSN09603</b> Networked Services	<b>CSN09604</b> Wireless Local Area Network	<b>SOC09609</b> Group Project
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**Module Outlines****CSN08601 – Computer Systems**

This module provides in-depth understanding and analysis of advanced topics relating to both hardware and software in modern computers of all sizes. The module also showcases and introduces Linux commands as well as Linux scripting. The module is split into two sections, one for Operating Systems (OS) and one for hardware.

Topics covered in the Operating System section include basic structure, components and functions of Operating Systems like the Kernel, scheduler, memory management, drivers, file systems, processes and threads. The logic of programme execution will be considered, using Linux to explore the topics. This knowledge is extended to the use of the Linux shell and practical shell scripting. Special consideration is made of the key security aspects which are available in operating systems to help provide information security and integrity.

The Hardware section covers the computer architecture across a wide range of technologies, ranging from embedded to desktop systems. This includes the Von Neumann architecture, CPU components and operations, instruction sets, and assembly language. Implementation issues are also considered, such as logical operations, number systems, number representations, and endianness.

**CSN08614 – Scripting for Cyber security and Networks**

The module covers the design, implementation and testing of applications integrated into a Linux system using a general-purpose programming language (Python). The aim of the module is to enable understanding of the principles of applications development for a range of applications types and to develop such application using a general-purpose scripting/programming language. The latter part of the module extends and contextualises the acquired developments skills through a series of case studies covering networking, distributed systems, security and forensics. Students with a Networking background benefit from learning to write scripts in a language that is very popular in their area, while students from a Software Development background benefit by gaining a developer's understanding of the security concepts showcased in the case studies.

The syllabus includes: Introduction to Scripting Languages, Building Applications using a general-purpose language, Modules, packages and libraries, Coding and scripting techniques, Exception handling, Systems Programming, Working with external data.

**SET09603 – Advanced Web Technologies**

This module guides students to use numerous powerful tools to develop scalable, tuneable, robust and secure user interfaces and APIs. It covers the protocol, practical client-side and server-side coding skills and other related issues, for example the safe collection of personal data. In terms

of technologies, the module teaches the Python-Flask micro-framework, and supporting WSGI capable servers.

### **CSN09603 – Networked Services**

This module gives a review/introduction to the Linux file system and command shell, and introduces the basics of user administration (account management), key elements of the Linux architecture, server network management, server security, gateway security, web server configuration, DNS, and administration troubleshooting. The topics of high performance and high-reliability environments are also discussed under a theme of critical assessment of nature and substance of topical issues in the field.

All practical sessions take place in an online learning environment (linuxzoo.net), which provides administrative access to virtual machines within a safe virtual networking environment. It also uses integrated practical assessments which are automatically graded with feedback. This allows students to work flexibly when required.

### **CSN09604 – Wireless Local Area Network**

This module is designed to equip students with essential knowledge on the operation, configuration and academic theory behind current and future wireless networks. Students will learn to critically reflect on the operation of a Wireless LAN, how to design, configure and maintain it in a cost-effective manner and will also grasp the basic concepts of wireless communication, which are carried forward in future wireless networks like the ones formed by IoT devices. The module is aligned with both Cisco Wireless LAN Fundamentals (CWLF) and Cisco Wireless LAN Advanced Topics (CWLAT) certifications. The principle covered topics are: Ethernet technologies (IEEE 802.3), 802.11 wireless LANs, Essentials of 802.11 physical layer technologies and radio systems, 802.11 wireless LAN security, Quality of Service for 802.11 (QoS), Voice over WLAN Infrastructure (VoWLAN), IP mobility, Future of wireless LANs (WiMaX, Mesh Network, WPAN, RFID, etc.), WLAN design.

### **CSN09612 – Network Security and Cryptography**

Upon completing this module, networking students will be equipped to securely manage a small network and will have the necessary knowledge to understand developments in the area, make critical decisions and contrast various potential solutions.

### **SOC09609 – Group Project**

Immersing students to a software-related group project will equip them with the necessary skills to work within a small team as well as allow them to apply the technical skills they have acquired so far. We expect them to work in a live project on a real world problems thus experiencing

working in the industry. We expect the Myanmar students to benefit from the same employability skills this module provides local ENU students.

### BSc (Hons) Computing – Software Development and Networking routes

For the Honours year you will complete the following modules for both routes:

<b>SET10614</b>	Data Analytics and Wrangling
<b>CSI10607</b>	Security, Audit and Compliance
<b>SET09623</b>	DevOps
<b>SET10613</b>	Secure Software Development
<b>SOC10603</b>	Honours Project (40 credits)

#### 4.2.7 Our Modular System

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In your course you must attend all days in all weeks as per the schedule available in Moodle.

##### Modules

Each standard module contributes 20 credits towards your degree, and this full-time undergraduate programme contain 10 standard modules and one double module and it is therefore worth  $10 \times 20 \text{ credits} + 1 \times 40 \text{ credits} = 240 \text{ credits}$ . The Honours project is a double module worth  $2 \times 20 = 40 \text{ credits}$ .

You are a direct entry to Year 3, therefore it is assumed that you already have gained 240 credits from your HND.

The 240 credits you will gain from this degree will result in a total of 480 credits, which are enough for an Honours Degree.

##### Compulsory and option modules

All modules in this degree are compulsory. Compulsory modules are modules which you **must** take within your programme of study.

#### 4.2.8 Course Prizes/Medals

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On being awarded with BSc (Hons) Computing, you may be selected as being the top performer of that cohort. This person would be awarded the class medal, which would be presented at the time of your graduation ceremony. We do not always award a medal, although sometimes we award more than one, and receiving the medal indicates you are at the top of your field.

#### 4.2.9 What facilities, field trips, equipment, software etc will I be using on my programme?

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All the equipment you need will be supplied to you during your studies. You will be using laptops for much of your practical work and a range of other devices like CISCO equipment. As well as this, much of the system you use will be cloud-based, allowing you to continue to work from home.

The course will give you access to a variety of activities like away days and field trips organised by IMC.

You will also get access to Edinburgh Napier's extensive online resources which include;

- a library with many e-books available for download
- the VSOC virtualised platform of the School of Computing which is a safe environment to experiment and learn new skills
- access to international publication repositories like IEEE Xplore and the ACM Digital Library
- access to Eduroam, a network of WiFi hot spots available in thousands of university campuses globally

#### **4.2.10 What should I do if I need further information and support about study skills, etc**

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As a university student, you want to get the most out of your studies and to develop as an effective learner. If you are experiencing any difficulties and would like to enhance your skills you are encouraged in the first instance to go along and speak to your IMC Programme Leader and at second instance to your Edinburgh Napier Programme Leader. These persons can provide you with some help and sign post you to other services on offer at the University.

## 5

**How do I submit my coursework/assignments?**

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It is really important that you read and understand the submission requirements for the modules that you are undertaking. Details of this will be included in the assessment brief. Most modules will require a submission via Moodle and will not require a printed copy. Some modules may require a demonstration.

**5.1** *What happens if I submit my assignments late?*

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Coursework submitted after the agreed deadline will be marked at a maximum of 40% (undergraduate). Coursework submitted over five working days after the agreed deadline will be given 0% (although formative feedback will be offered where requested).

**5.2** *What do I do if I am absent due to illness or other personal circumstances?*

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It is your responsibility to let both your Programme Leaders know if you are going to be absent from classes. When you come back you will need to ensure that you are aware of what happened in any missed classes and make sure you catch up.

### 5.3 *What should I do if I am ill or absent on the day an assignment is due or on the day of an examination?*

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If you are ill on the day of an examination you need to let both your Programme Leaders know. The University has Exceptional Circumstances Regulations which can be found on myNapier. These will be applied in conjunction with IMC processes. Please read these if you are having difficulty in meeting deadlines due to illness.

If you know that you will not meet with a deadline due to exceptional circumstances you may wish to contact both your Programme Leaders to apply for an extension.

Details of the submission dates will be published by the module leaders.

### 5.4 *Plagiarism and what this means*

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Plagiarism at Edinburgh Napier is defined as the “unacknowledged incorporation in a student’s work either in an examination or assessment of material derived from the work (published or unpublished) of another.” This means that you may not use work from others and call it your own. Work in this context applies to any form of work (and not only written work). It therefore also applies to music, art, audio and drama.

Plagiarism is considered a breach of academic conduct regulations. It is considered a serious offence and is dealt with according to the University’s Student disciplinary regulations and Academic conduct: Code of practice for staff and students.

Good referencing practice is the best way to avoid unintentional plagiarism and you will find help and resources about this on the **Be Wise, Don’t Plagiarise** website.

Your School Academic Conduct Officer (ACO) is responsible for investigating allegations of breach of Academic Conduct Regulations.

#### **Academic conduct officer**

Malcolm Rutter                      m.rutter@napier.ac.uk

Due to the nature of this course, an investigation may be undertaken via electronic communication means and without a physical meeting.

### 5.5 *Fit to Sit and Extenuating Circumstances*

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If you take part in an assessment, whether handing in a coursework, sitting a test or taking another kind of assessment you are declaring yourself to be well enough to do so: in other words you are “Fit to Sit”.

However, occasionally things can go wrong with your health or personal life that can impact on your studies. The University calls these “Extenuating Circumstances” and has a process to support you. You will find full details of our processes on our myNapier pages.

If you are experiencing such difficulties, you should speak to a member of staff for support, advice and guidance. The most appropriate person is usually your IMC Programme Leader and then your Edinburgh Napier Programme Leader. In addition your School has an Extenuating Circumstances Officer (ECO) who will deal with administrative arrangements.



**It is your responsibility to ensure that your Extenuating Circumstances form is submitted by the required deadline.**



**6****When will I get my feedback and marks?**

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**6.1** *How and when do I get feedback on my assignments?*

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The University currently undertakes to ensure that students will get feedback on their work within three working weeks of the assessment being submitted. Details of the exact date and form of this feedback will be published by the module leaders.

Very occasionally there may be an issue associated with getting feedback back to students within the 3 week time limit e.g. due to staff illness. Should there be a delay, students will be informed by the Module Leader. Details of the revised feedback date may be given during class, via email, Moodle etc, – so please check for any changes. When you receive your feedback you will also get a preliminary mark until this mark is considered at the Module Board of Examiners it is not agreed and final.

**6.2** *How do I know if I have passed?*

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There are different pass marks/grades depending on the level of study that you are undertaking. To pass an undergraduate module you must get 40% overall. Each module may be made up of one or two components; and each component of assessment may contain a number of elements, e.g. the assessment component may be a portfolio of work which contains a Powerpoint Presentation, a report and a series of class tests. These would be known as the elements which make up the component. The weighting components and elements can be found within the module descriptor. You can find out about the specifics of how overall marks/grades are calculated within the University Regulations.

**6.3** *When will I get my results?*

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You will normally get your mark/grade for each individual assessment or piece of work at the same time as you get your feedback on the assessment. Normally this will be with you within 3 working weeks. However, these marks at this stage are still preliminary and have to be confirmed by your Module and Programme Boards of Examiners. These Boards normally meet after the end of your degree. Your confirmed results will be available through your student account and the date of when this is available can be found on myNapier.

**6.4** *What if I have failed?*

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Do not panic if you have failed a module. Help can be obtained from a number of people. In the first instance you can contact your module leader or Edinburgh Napier Programme Leader to talk through what will happen regarding reassessment. You can also ask for additional support



from your module leader as you prepare for any reassessment. Information on reassessment, what is expected, submission and examination dates can also be obtained from the Moodle site of the module.

## **6.5** *Reassessment*

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Reassessment is when you need to resit an assessment due to having failed it. Reassessments scheduling will be documented in the Moodle page for each module, and may be shortly after the module is formally finished or many months after the end. Please double check this with your Module leader.

Note that sometimes failing only a single module in the year will not result in a resit, especially if the failure margin is small. This compensation scheme is not to be relied on though, and you should try to pass all assessments the first time, as well as properly attempt resits as directed.

## **6.6** *Boards of Examiners*

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Boards of Examiners are responsible for making decisions about your academic performance, including whether you have passed or failed a module, whether you can continue on a programme of study and what your final award will be.

Further information about the role of module and programme boards can be found in Section A of the University academic regulations.

### **6.6.1 Programme and Module External Examiners**

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External examiners are experienced university teachers from other institutions who provide an overall independent judgement on general student performance and the quality and standard of your programme of study.

They do not mark your work. You should also note that it is not part of their remit to communicate with individual students

## 7

**What opportunities will there be on my programme to provide feedback to staff?**

You will find during your programme that your module leaders will seek feedback from you informally during the trimester. They will be keen to hear what you and your class mates are enjoying, what is going well and any concerns or changes which you feel might be required.

After the end of the module, there will be the opportunity to complete a module evaluation questionnaire. Here you can give your views on key aspects of the module, including the teaching and learning you have experienced, the assessment and feedback you have received, and comment on the resources used to support the delivery of the module.

Together with IMC, we will organise meetings with class representatives to discuss the course.



8

## Graduation – What is it?

Graduation is an important occasion to celebrate your success with your family and friends. Graduation for this course will be organized by IMC who will tell you what you will need to do to prepare for it.

You could also choose to graduate at Edinburgh Napier either in June or October. You could make a family holiday around the event which is held in the Usher Hall, Edinburgh.





**Info Myanmar University (IMU)**

ဝန်ထမ်းသက်သာချောင်ချိရေး အစီအစဉ်





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- တက္ကသိုလ် ပညာသင်ယူဆဲ ရုံးဝန်ထမ်းများ အတွက် အဝေးသင်တက္ကသိုလ်စာမေးပွဲ ဖြေဆိုနိုင်ရန် စီစဉ်ပံ့ပိုးပေးခြင်း
- တူညီဝတ်စုံပံ့ပိုးပေးခြင်း
- Annual Staff Party ကျင်းပပေးခြင်း နှင့် Best Performance Award အဖြစ် အသုံးအဆောင်ပစ္စည်းများ (ရွှေ၊ ကား၊ ရေခဲသေတ္တာ၊ အဝတ်လျှော်စက်) များပေးအပ်ခြင်း
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- စာကြည့်တိုက်ဖွင့်လှစ်ပေးခြင်း
- ကျောင်းတွင်း စားသောက်ဆိုင်ဖွင့်လှစ်ထားပေးခြင်း
- ရာသီအလိုက် ရိုးရာယဉ်ကျေးမှုဆိုင်ရာ၊ ဘာသာရေးဆိုင်ရာ ပျော်ပွဲရွှင်ပွဲများ ကျင်းပပေးခြင်း
- နားနေခန်း နှင့် အရေးပေါ်ဆေးသေတ္တာ ထားရှိပေးခြင်း

အနာဂတ်ကာလတွင် အောက်ဖော်ပြပါအစီအစဉ်များကိုလည်း ပြုလုပ်ဆောင်ရွက်မည်ဖြစ်ကြောင်း တင်ပြအပ်ပါသည်။

- ဆရာ၊ဆရာမများ နှင့် ဝန်ထမ်းများ အတွက်ကြိုပို့ကားစီစဉ်ပေးခြင်း
- ညဘက်မိုးချုပ်ပါက ညစာ စီစဉ်ပေးခြင်း ၊ ခရီးစရိတ်စီစဉ်ပေးခြင်း
- အရေးပေါ်ဆေးပေးခန်းထားရှိခြင်း
- ဝန်ထမ်းများအား မွေးနေ့ပွဲ ကျင်းပပေးခြင်း။

လေးစားစွာဖြင့်

နနသန့်

Founder & Managing Director

IMCS Co., Ltd.



## ဝန်ထမ်းများအား တူညီဝတ်စုံပံ့ပိုးပေးခြင်း



## Annual Staff Party ကျင်းပပေးခြင်း





ဝန်ထမ်းများအား အပန်းဖြေခရီးများ ပို့ဆောင်ပေးခြင်း





# စာကြည့်တိုက်ဖွင့်လှစ်ပေးခြင်း





## ကျောင်းတွင်းစားသောက်ဆိုင်ဖွင့်လှစ်ပေးထားခြင်း



## နားနေခန်း ထားရှိပေးခြင်း



## ဆေးသေတ္တာထားရှိပေးခြင်း







**Info Myanmar University (IMU)**

ကျန်းမာသန့်ရှင်းရေး၊ ကျောင်းလုံခြုံရေး နှင့်  
မီးဘေးကာကွယ်ရေး အစီအစဉ်



သို့.

ဥက္ကဋ္ဌ

မြန်မာနိုင်ငံ ရင်းနှီးမြှုပ်နှံမှုကော်မရှင်

ရန်ကုန်မြို့။

စာအမှတ် ။ IMC/Admin/2019(179)

ရက်စွဲ ။ ၂၀၁၉ ခုနှစ်၊ မေလ၊ ၉ရက်။

**အကြောင်းအရာ။ ။ ကျန်းမာသန့်ရှင်းရေး၊ ကျောင်းလုံခြုံရေး နှင့် မီးဘေးကာကွယ်ရေး အစီအစဉ်များ ဆောင်ရွက်ထားရှိမှု တင်ပြခြင်း။**

အထက်အကြောင်းအရာပါကိစ္စနှင့်စပ်လျဉ်း၍ ကျွန်ုပ်တို့၏ IMCS (Institute of Management & Computer Studies) Company Limited ၊ ကုမ္ပဏီ မှတ်ပုံတင်အမှတ် (103990572)သည် Info Myanmar University အမည်ဖြင့် ပုဂ္ဂလိကပညာရေး ဝန်ဆောင်မှုများ ဆောင်ရွက်နိုင်ရန် ကျန်းမာသန့်ရှင်းရေး၊ ကျောင်းလုံခြုံရေး နှင့် မီးဘေးကြိုတင် ကာကွယ်ရေး အစီအစဉ်များအား အောက်ဖော်ပြပါ အချက်အလက်များအတိုင်း ပြင်ဆင်ထားပြီး ဖြစ်ကြောင်း တင်ပြအပ်ပါသည်။

**ကျန်းမာသန့်ရှင်းရေး နှင့် ကျောင်းလုံခြုံရေး အစီအစဉ်**

- သန့်ရှင်းကျန်းမာစေရန် ကျောင်းသား၊ ကျောင်းသူတစ်ဦးစီအတွက် သီးသန့်သောက်ရေခွက် ပံ့ပိုးပေးခြင်း
- သန့်ရှင်းသပ်ရပ်သော ကျောင်းတွင်း စားသောက်ဆိုင် စီစဉ်ထားရှိပေးခြင်း
- ကျောင်းသား၊ကျောင်းသူ တစ်ဦးစီအတွက် သီးသန့် Locker တစ်လုံးစီ စီစဉ်ထားရှိပေးခြင်း
- အရေးပေါ် ဆေးသေတ္တာ ထားရှိပေးခြင်း
- ကျောင်းဝင်းလုံခြုံရေးအတွက် လုံခြုံရေးဝန်ထမ်းများ ခန့်ထားခြင်း
- လုံခြုံရေး ကင်မရာ (CCTV) များ တပ်ဆင်ထားရှိခြင်း

**မီးဘေးကြိုတင် ကာကွယ်ရေး အစီအစဉ်**

- မီးဘေးကြိုတင်ကာကွယ်ရေး၊ မီးငြိမ်းသတ်ရေးနှင့် မီးသတ်ဆေးဘူး အသုံးပြုနည်းသင်တန်းပေးခြင်း
- အချက်ပေးစနစ်များတပ်ဆင်ထားခြင်း
- ရေလှောင်ကန် ထားရှိခြင်း
- မီးသတ်ဆေးဘူးများ ထားရှိခြင်း
- မီးသတ်ဆေးဘူးများ လစဉ်ပုံမှန်စစ်ဆေးခြင်း



- လျှပ်စစ် ဝါယာများအား နေ့စဉ် အပူချိန်တိုင်းတာ၍ ကြိုဆိုင်မှု စစ်ဆေးခြင်း။
- မီးအာမခံထားခြင်း
- မတော်တဆဖြစ်သော မီးဘေးအန္တရာယ်ကို ကြိုတင်ကာကွယ်ရန်အတွက် ကျောင်းပရဂျက် တစ်ခုလုံးကို ဆေးလိပ်ကင်းစင်နယ်မြေ အဖြစ် သတ်မှတ်ထားခြင်း

လေးစားစွာဖြင့်

နီနီသန့်

Founder & Managing Director

IMCS Co., Ltd.



## သီးသန့်သောက်ရေခွက်



## ကျောင်းတွင်း စားသောက်ဆိုင်



## သီးသန့် Locker





## လုံခြုံရေးဝန်ထမ်းများ ခန့်ထားခြင်း





## CCTV များ တပ်ဆင်ထားရှိခြင်း





မီးဘေးကြိုတင်ကာကွယ်ရေးနှင့် ငြိမ်းသတ်ရေး၊ မီးသတ်ဆေးဘူးများ အသုံးပြုနည်းသင်တန်း





မီးဘေးကြိုတင်ကာကွယ်ရေးနှင့် ငြိမ်းသတ်ရေး၊ မီးသတ်ဆေးဘူးများ အသုံးပြုနည်းသင်တန်း



## အချက်ပေးစနစ်များ တပ်ဆင်ထားခြင်း





ရေလှောင်ကန်ထားရှိခြင်း

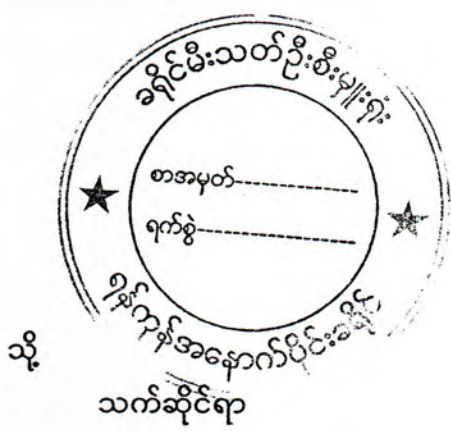


## လုံခြုံရေးကင်မရာ (CCTV) များ တပ်ဆင်ထားခြင်း









ခ ရိုင် မီး သတ် ဦး စီး မှူး ရုံး  
အနောက်ပိုင်းခရိုင် - ရန်ကုန်တိုင်းဒေသကြီး  
စာအမှတ်၊ ၁၀၂ / ၁၀ / ၅ / ဦး - ၁  
ရက်စွဲ၊ ၂၀၁၉ခုနှစ်၊ ဇန်နဝါရီလ ၁၇ ရက်

အကြောင်းအရာ။ ထောက်ခံချက်ပေးခြင်း

ရန်ကုန်တိုင်းဒေသကြီး၊ အနောက်ပိုင်းခရိုင်၊ ကမာရွတ်မြို့နယ်၊ ပြည်ရိပ်သာလမ်း၊ အမှတ်(၇)ရှိ Info Myanmar College ရှိ ကျောင်းသား/ကျောင်းသူ (၁၅၀)ဦးခန့်၊ ဆရာ/ဆရာမများနှင့် ဝန်ထမ်းများအား (၁၇.၁.၂၀၁၉) ရက်နေ့ နေ့လည်(၁၃ : ၃၀)အချိန်တွင် အနောက်ပိုင်းခရိုင်မီးသတ်ဦးစီးမှူး လက်ထောက်ညွှန်ကြားရေးမှူး ဦးဌေးဝင်း ဦးဆောင်၍ မီးဘေးကြိုတင်ကာကွယ်ရေး ဟောပြောပွဲနှင့် လက်တွေ့သရုပ်ပြမီးငြိမ်းသတ်ခြင်း လုပ်ငန်းများ ဆောင်ရွက်ပြီးစီးသည်မှာ မှန်ကန်ကြောင်း ထောက်ခံအပ်ပါသည်။

ဦးဇော်

ခရိုင်မီးသတ်ဦးစီးမှူး  
( ဌေးဝင်း ၊ လက်ထောက်ညွှန်ကြားရေးမှူး )  
ရန်ကုန်အနောက်ပိုင်းခရိုင်

မိတ္တူ

ရုံးလက်ခံ



Grand Guardian Insurance Public Co., Ltd.  
Fire Insurance Department  
Cash Receipt (New Business)

Customer Receipt

Receipt Date - 29/03/2018

Policy No. - 2018-F0009082-FR1  
Cash Receipt No - R0022384  
Print by - FNRB01U01

Branch - Junction Square  
Policy Type - Fire - FR1  
Payment Method - CASH  
CHEQUE No. -  
Bank Code - Junction Square Cash MMK  
Period - From 29/03/2018 To 29/03/2019  
Agent Name - NYI NYI MIN HTET (IA(O)0151)  
Insured Name - INFO MYANMAR COLLEGE(IMCS CO;LTD) (CAMPUS-1)

Sum Insured	91,307,200.00 MMK
Premium	0.00 MMK
NCB	0.00 MMK
Additional Premium	0.00 MMK
Penalty Premium	0.00 MMK
Net Premium	0.00 MMK
Service Charges	0.00 MMK
Policy Stamp Fees	0.00 MMK
Total	182,614.40 MMK

Customer Address - NO.(505/7), PYI YATE THAR STREET, KAMARYUT, YANGON  
Insured Property Address - NO.(507/3), PYI YEIK THAR STREET, KAMARYUT T/S, YANGON

Grand Guardian Insurance  
Public Co., Ltd (HO)

Received Cash

Ks. 182,614 / 90

3 MAR 2018

Asst. Cashier

Manager

Authorized Signature

Authorized Signature

Cashier's Stamp





INSURANCE • အာမခံ

## FIRE INSURANCE POLICY

THIS POLICY WITNESSETH THAT in consideration of the sum of premium stated in the Schedule attached, paid to Grand Guardian Insurance Public Co., Ltd. hereinafter called, "the Company" by the Insured named in the, Schedule TO INSURE AGAINST LOSS OF OR DAMAGE BY FIRE OR LIGHTNING to the PROPERTY described in the sum or several sums as per the Schedule, the Company hereby agrees with the Insured subject to the conditions printed on the back hereof and endorsed thereon which are to be taken together as part of the Policy, that if the Property herein described shall be destroyed or damaged by FIRE OR LIGHTNING, the Company shall be liable TO PAY OR MAKE GOOD to the Insured the Value at the time of happening of such loss of the Property so damaged or the Amount of such damage which shall or may happen during the PERIOD OF INSURANCE stated in the Schedule or during any SUBSEQUENT PERIOD for which renewal premium has been received by the Company, not exceeding in respect of the matter or matters above specified the sum or sums set opposite thereto respectively and not exceeding in the whole the sum insured stated in the Schedule.

N.B Any Warranties to which the Property insured or any item thereof is or at any time be made subject shall attach and continue to be in force during the whole of the currency of the Policy and non-compliance at any time with any of the Warranties shall be a bar to any claim in respect of such Property or item.



(Thin Zar Pwint Phyu)  
Deputy General Manager  
Grand Guardian Insurance Public Co., Ltd.  
*[Signature]* (Authorized Signature)

For Grand Guardian Insurance Public Co., Ltd.

Date 29 MAR 2018

Grand Guardian Insurance Public Co., Ltd.



## SCHEDULE

Junction Square

Quotation No - 00004687

Policy No - 2018-F0009082-FR1

Total Sum Insured Kyats/USD 91,307,200.00

Insured Name & Address . INFO MYANMAR COLLEGE(IMCS CO;LTD) (CAMPUS-1)/ NO.(505/7), PYI YATE THAR STREET,,  
KAMARYUT, YANGON

Period ( 12 ) months 29/03/2018 to 29/03/2019 (12:00 p.m)  
effective from the time at which time the first premium is received.

Agent's Name NYI NYI MIN HTET (IA(O)0151)

Situation of Premises NO.(507/3), PYI YEIK THAR STREET, KAMARYUT T/S, YANGON  
(Insured Property Address)

Construction of building See List Attached

Occupation of building See List Attached

Declared for Insurance

Premium Rate

Additional Cover See List Attached

Additional Premium Rate

Total Premium Kyats/USD



(Thin Zar Phyu)  
Deputy General Manager  
Grand Guardian Insurance Public Co., Ltd.  
Authorized Signature

Building Name (Insured Property Address)	Construction of Building	Occupation of Building	Building	Furniture	Machinery	Stock Of Goods	Total Sum Insured	Rate													Total Additional Premium	Total Basic Premium	NCB	Total Premium
								FIRE	RSM	War	Burg	EXP	S & J	Storm	F & L	E.Q	AIR	SP	Impact					
GRAND BUILDING NO.(507/3), PYI YEIK THAR STREET, KAMARYUT T/S, YANGON	1st Building Class	Schools / Colleges / Universit	0.00	10,060,200.00	0.00	0.00	10,060,200.00	0.20%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00	20,120.40	0.00	20,120.40
BUILDING NO.(507/3), PYI YEIK THAR STREET, KAMARYUT T/S, YANGON	1st Building Class	Schools / Colleges / Universit	0.00	0.00	81,247,000.00	0.00	81,247,000.00	0.20%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00	162,494.00	0.00	162,494.00
Grand Total							91,307,200.00														0.00	182,614.40	0.00	182,614.40

(Thin Zar Pwint Phyu)  
Deputy General Manager  
Grand Guardian Insurance Public Co., Ltd.





Grand Guardian Insurance Public Co., Ltd  
No. (19/20) A, B, C, D, Junction Square Compound,  
Pyay Road, Kamayout Township,  
Yangon, Myanmar.

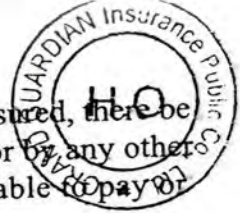
T (+951) 230 5700, 230 5701  
F (+951) 230 4368  
E [Info@ggipinsurance.com](mailto:Info@ggipinsurance.com)  
[www.ggipinsurance.com](http://www.ggipinsurance.com)

## ENDORSEMENT

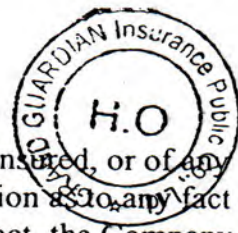
### AGREED VALUE

It is hereby declared and agreed that in the event of the item(s) of property insured being totally lost, destroyed or damage by any peril insured against, the liability of the insurers shall not exceed the corresponding agreed value stated in the schedule.

18. If at the time of any loss or damage happening to any property hereby insured, there be any other subsisting Insurance or Insurances, whether effected by the Insured or by any other person or persons, covering the same property, this Company shall not be liable to pay or contribute more than its ratable proportion of such loss or damage.
19. If the property hereby insured shall, at the breaking out of any fire, be collectively of greater value than the sum insured thereon, then the Insured shall be considered as being his own Insurer for the difference, and shall bear a rateable proportion of the loss or damage accordingly. Every item, if more than one, of the Policy shall be separately subject to this Condition.
20. In the event of a loss or damage, the insurance hereunder shall be maintained in force for the full sum insured and the Insured shall be liable to pay an additional premium at the rate stated in the Policy calculated on the amount of loss or damage on a pro rata basis from the date of such loss or damage to the expiry of the current period of insurance.
21. If any difference arises as to the amount of any loss or damage, such difference shall independently of all other questions be referred to the decision of an Arbitrator, to be appointed in writing by the parties in difference, or, if they cannot agree upon a single Arbitrator, to the decision of two disinterested persons as Arbitrators, of whom one shall be appointed in writing by each of the parties within two (2) calendar months after having been required so to do in writing by the other party. In case either party shall refuse or fail to appoint an Arbitrator within two (2) calendar months after receipt of notice in writing requiring an appointment, the other party shall be at liberty to appoint a sole Arbitrator; and in case of disagreement between the Arbitrators, the difference shall be referred to the decision of Umpire who shall have been appointed by them in writing before entering on the reference, and who shall sit with the Arbitrators and preside at their meetings. The death of any party shall not revoke or affect the authority or powers of the Arbitrator, Arbitrators or Umpire respectively; and in the event of the death of an Arbitrator or Umpire, another shall in each case be appointed in his stead by the party or Arbitrators (as the case may be) by whom the Arbitrator or Umpire so dying was appointed. The costs of the reference and of the award shall be in the discretion of the Arbitrator, Arbitrators or Umpire making the award. And it is hereby expressly stipulated and declared that it shall be a condition precedent to any right of action or suit upon this Policy that the award by such Arbitrator, Arbitrators or Umpire of the amount of the loss or damage if disputed shall first obtained.
22. In no case whatever shall the Company be liable for any loss or damage after the expiration of twelve (12) months from the happening of the loss or damage unless the claim is the subject of pending action of arbitration.
23. Every notice and other communication to the Company required by these Conditions must be written or printed.
24. In the event of a loss or damage unless all the necessary documents in support of the claim are received by the Company within (3) years from the date of the loss or damage all benefit under this Policy shall be forfeited.







**THE CONDITIONS UPON WHICH THIS INSURANCE IS GRANTED:-**

1. If there be any material misdescription of any of the property hereby insured, or of any building or place in which such property is contained, or any misrepresentation as to any fact material to be known for estimating the risk, or any omission to state such fact, the Company shall not be liable upon this Policy so far as it relates to the property affected by any such misdescription, misrepresentation or omission.
2. No payment in respect of any premium shall be deemed to be payment to the Company unless a printed form of receipt for the same signed by an Official or duly appointed Agent of the Company shall have been given to the Insured.
3. The Insured shall give notice to the Company of any Insurance or Insurances already effected, or which may subsequently be effected, covering any of the property hereby insured, and unless such notice be given and the particulars of such Insurance or Insurances be stated in or endorsed on this Policy by or on behalf of the Company before the occurrence of any loss or damage, all benefit under this Policy shall be forfeited.
4. All Insurances under this Policy
  - (1) on any building or part of any building,
  - (2) on any property contained in any building,
  - (3) on rent or other subject matter of insurance in respect of or in connection with any building or any property contained in any building, shall cease immediately upon any fall or displacement.
    - (a) of such building or of any part thereof,
    - (b) of the whole or any part of any range of buildings or of any structure of which such building forms part.

PROVIDED that such fall or displacement is of the whole or substantial or Important part of such building or impairs the usefulness of such building or any part thereof or leaves such building or any part thereof or any property contained therein subject to increased risk of fire or is otherwise material.

AND PROVIDED that such fall or displacement is not caused by fire, loss or damage which is covered by this Policy or would be covered if such building, range of buildings or structure were insured under this Policy.

In any action, suit or other proceeding, the burden of proving that any fall or displacement is caused by fire as aforesaid shall be upon the Insured.

5. (1) This insurance does not cover:
  - (a) Loss by theft during or after the occurrence of a fire.
  - (b) Loss of or damage to the property occasioned by its own fermentation, natural heating or spontaneous combustion {except as may be provided in accordance with Condition 8(f)} or by its undergoing any heating or drying process.
  - (c) Loss or damage occasioned by or through or in consequence of
    - (1) The burning of property by order of any public authority
    - (2) Subterranean Fire
  - (d) Loss or damage directly or indirectly caused by or arising from or in consequence of or contributed to by nuclear weapons material.
5. (2) This insurance does not cover loss or damage directly or indirectly caused by or arising from or in consequence of or contributed to by ionising radiations or contamination by radioactivity from any nuclear fuel or from any nuclear waste from the combustion of nuclear fuel. For the purposes of this Condition 5(2) only combustion shall include any self-sustaining process of nuclear fission.
6. This insurance does not cover any loss or damage occasioned by or through or in consequence, directly or indirectly, of any of the following occurrences, namely:-



- (a) Earthquake, volcanic eruption or other convulsion of nature.
- (b) Typhoon, hurricane, tornado, cyclone or other atmospheric disturbance.
- (c) War, invasion, act of foreign enemy, hostilities or warlike operations (whether war be declared or not) or civil war.
- (d) Mutiny, riot, military or popular rising, insurrection, rebellion, revolution, military or usurped power, martial law or state of siege or any of the events or causes which determine the proclamation or maintenance of martial law or state of siege.
- (e) Any act of terrorism.

For this purpose an act of terrorism means an act including but not limited to the use of force or violence and/ or threat thereof any person or group(s) of persons, whether acting alone or on behalf of or in connection with any organization(s) or government(s), committed for political, religious ideological or similar purpose including the intention to influence any government and/ or to put the public or any section of the public in fear.

Any loss or damage happening during the existence of abnormal conditions (whether physical or otherwise) which are occasioned by or through or in consequence, directly or indirectly, of any of the said occurrences shall be deemed to be loss or damage which is not covered by this insurance, except to the extent that the Insured shall prove that such loss or damage happened independently of the existence of such abnormal conditions.

In any action, suit or other proceeding where the Company alleges that by reason of the provisions of this condition any loss or damage is not covered by this insurance, the burden of proving that such loss or damage is covered shall be upon the Insured.

7. This insurance does not cover any liability for:  
Loss or destruction or damage caused by pollution or contamination except (unless otherwise excluded) destruction of or damage to the property insured caused by
  - (i) pollution or contamination which itself results from contingency hereby insured against.
  - (ii) any contingency hereby insured against which itself results from pollution or contamination.
8. Unless otherwise expressly stated in the Policy this insurance does not cover:
  - (a) Goods held in trust or on commission.
  - (b) Bullion or unset precious stones.
  - (c) Any curiosity or work of art for an amount exceeding Ks-(50,000)
  - (d) Manuscripts, plans, drawings, or designs, patterns, models or moulds.
  - (e) Securities, obligations, or documents of any kind, stamps, coined or paper money, cheques, books of account or other business books, or computer systems records.
  - (f) Coal, against loss or damage occasioned by its own spontaneous combustion.
  - (g) Explosives.
  - (h) Any loss or damage occasioned by or through or in consequence of explosion; but loss or damage by explosion of gas used for illuminating or domestic purpose in a building in which gas is not generated and which does not form part of any gas works, will be deemed to be loss by fire within the meaning of this Policy.
  - (i) Any loss or damage occasioned by or through or in consequence of the burning, whether accidental or otherwise, of forests, bush, prairie, pampas or jungle, and the clearing or lands by fire.
9. Under any of the following circumstances the insurance ceased to attach as regards the property affected unless the Insured, before the occurrence of any loss or damage, obtains the sanction of the Company signified by endorsement upon the Policy, by or on behalf of the Company.





- (a) If the trade or manufacture carried on be altered, or if the nature of the occupation of or other circumstances affecting the building insured or contained the insured property be changed in such a way as to increase the risk of loss or damage by fire.
  - (b) If the building insured or containing the insured property becomes unoccupied and so remains for a period of more than thirty (30) days.
  - (c) If the property insured be removed to any building or place other than that in which it is herein stated to be insured.
  - (d) If the interest in the property insured passes from the Insured otherwise than by will or operation of law.
  - (e) If a notice to quit by any order by the local Authorities for the requisition or acquisition of the land on which the Insured's property is situated has been issued.
10. This insurance does not cover any loss or damage to the property which, at the time of the happening of such loss or damage, is insured by or would, but for the existence of this Policy, be insured by any Marine Policy or Policies except in respect of any excess beyond the amount which would have been payable under the Marine Policy or Policies had this insurance not been effected.
11. This insurance may be terminated at any time at the request of the Insured in which case the Company will retain a proportion of the premium calculated at the customary short period rate for the time the policy has been in force. This insurance may also be terminated at the option of the Company by sending fourteen (14) days' notice by registered letter to the Insured at his last known address, in which case the Company shall be liable to repay on demand a rateable proportion of the premium for the unexpired term from the date of termination.
12. On the happening of any loss or damage the Insured shall forthwith give notice thereof to the Company and shall within (15) days after the loss or damage, or such further time as the Company may in writing allow in that behalf, deliver to the Company.
- (a) A Claim in writing for the loss or damage containing as particular an account as may be reasonably practicable of all the several articles or items of the property damaged or destroyed, and of the amount of the loss or damage thereto respectively, having regard to their value at the time of the loss or damage, not including profit of any kind.
  - (b) Particulars of all other Insurances, if any.
- The Insured shall also at all times at his own expense produce, procure and give to the Company all such further particulars, plans, specifications, books, vouchers, invoices, duplicates or copies thereof, documents, proofs and information with respect to the claim and the origin and cause of the fire and the circumstances under which the loss or damage occurred, and any matter touching the liability or the amount of the liability of the Company as may be reasonably required by or on behalf of the Company together with a declaration on oath or in other legal form of the truth of the claim and of any matters connected therewith.

No Claim under this Policy shall be payable unless the terms of this Condition have been complied with.

13. The insurance under this policy extends to include:-

- (a) wages of the Insured's employees other than full-time members of a Works Fire Brigade.
- (b) the cost of replacement of fire fighting appliances and destruction of or damage to materials (including employee's clothing and personal effects) unless otherwise specifically insured.
- (c) Fire Brigade charges.

Provided always that the liability of the Company in respect of such wages, costs and charges shall be limited to those necessarily and reasonably incurred in extinguishing fires at or adjoining the situation of the property insured by this Policy or immediately threatening to involve such property.



14. On the happening of any loss or damage to any of the property insured by this Policy, the Company may:-

- (a) Enter and take and keep possession of the building or premises where the loss or damage has happened.
- (b) Take possession of or require to be delivered to it any property of the Insured in the building or on the premises at the time of the loss or damage.
- (c) Keep possession of any such property and examine, sort, arrange, remove, or otherwise deal with the same.
- (d) Sell any such property or dispose of the same for account of whom it may concern.

The powers conferred by this Condition shall be exercisable by the Company at any time until notice in writing is given by the Insured that he makes no claim under the Policy or, if any claim is made, until such claim is finally determined or withdrawn, and the Company shall not by any act done in the exercise or purported exercise of its powers hereunder, incur any liability to the Insured or diminish its right to rely upon any of the conditions of this Policy in answer to any claim.

If the Insured or any person on his behalf shall not comply with the requirements of the Company or shall hinder or obstruct the Company in the exercise of its power hereunder, all benefit under this Policy shall be forfeited.

The Insured shall not in any case be entitled to abandon any property to the Company whether taken possession of by the Company or not.

15. If the claim be in any respect fraudulent, or if any false declaration be made or used in support thereof, or if any fraudulent means or devices are used by the Insured or any one acting on his behalf to obtain any benefit under this Policy; or, if the loss or damage be occasioned by the willful act, or with the connivance of the Insured; or, if the claim be made and rejected and an action or suit be not commenced within three (3) months after such rejection, or (in the case of an Arbitration taking place in pursuance of the 21<sup>st</sup> Condition of this Policy) within three (3) months after the Arbitrator or Arbitrators of Umpire shall have made their award, all benefit under this Policy shall be forfeited.

16. The Company may at its option reinstate or replace the property damaged or destroyed, or any part thereof, instead of paying the amount of the loss or damage, or may join with any other Company or Insurers in so doing; but the Company shall not be bound to reinstate exactly or completely, but only as circumstances permit and in reasonably sufficient manner, and in no case shall the Company be bound to expend more in reinstatement than it would have cost to reinstate such property as it was at the time of the occurrence of such loss or damage, nor more than the sum insured by the Company thereon.

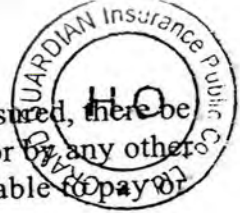
If the Company so elects to reinstate or replace any property, the Insured shall, at his own expense, furnish the Company with such plans, specifications, measurements, quantities, and such other particulars as the Company may require, and no acts done, or caused to be done by the Company with a view to reinstatement or replacement shall be deemed an election by the Company to reinstate or replace.

If in any case the Company shall be unable to reinstate or repair the property hereby insured, because of any municipal or other regulations in force affecting the alignment of streets, or the construction of buildings, or otherwise, the Company shall, in every such case, only be liable to pay such sum as would be requisite to reinstate or repair such property if the same could lawfully be reinstated to its former condition.

17. The Insured shall, at the expense of the Company, do, and concur in doing, permit to be done, all such acts and things as may be necessary or reasonably required by the Company for the purpose of enforcing any rights and remedies, or of obtaining relief of indemnity from other parties to which the Company shall be or would become entitled or subrogated, upon its paying for or making good any loss or damage under this Policy, whether such acts and things shall be or become necessary or required before or after his indemnification by the Company.



18. If at the time of any loss or damage happening to any property hereby insured, there be any other subsisting Insurance or Insurances, whether effected by the Insured or by any other person or persons, covering the same property, this Company shall not be liable to pay or contribute more than its ratable proportion of such loss or damage.
19. If the property hereby insured shall, at the breaking out of any fire, be collectively of greater value than the sum insured thereon, then the Insured shall be considered as being his own Insurer for the difference, and shall bear a rateable proportion of the loss or damage accordingly. Every item, if more than one, of the Policy shall be separately subject to this Condition.
20. In the event of a loss or damage, the insurance hereunder shall be maintained in force for the full sum insured and the Insured shall be liable to pay an additional premium at the rate stated in the Policy calculated on the amount of loss or damage on a pro rata basis from the date of such loss or damage to the expiry of the current period of insurance.
21. If any difference arises as to the amount of any loss or damage, such difference shall independently of all other questions be referred to the decision of an Arbitrator, to be appointed in writing by the parties in difference, or, if they cannot agree upon a single Arbitrator, to the decision of two disinterested persons as Arbitrators, of whom one shall be appointed in writing by each of the parties within two (2) calendar months after having been required so to do in writing by the other party. In case either party shall refuse or fail to appoint an Arbitrator within two (2) calendar months after receipt of notice in writing requiring an appointment, the other party shall be at liberty to appoint a sole Arbitrator; and in case of disagreement between the Arbitrators, the difference shall be referred to the decision of Umpire who shall have been appointed by them in writing before entering on the reference, and who shall sit with the Arbitrators and preside at their meetings. The death of any party shall not revoke or affect the authority or powers of the Arbitrator, Arbitrators or Umpire respectively; and in the event of the death of an Arbitrator or Umpire, another shall in each case be appointed in his stead by the party or Arbitrators (as the case may be) by whom the Arbitrator or Umpire so dying was appointed. The costs of the reference and of the award shall be in the discretion of the Arbitrator, Arbitrators or Umpire making the award. And it is hereby expressly stipulated and declared that it shall be a condition precedent to any right of action or suit upon this Policy that the award by such Arbitrator, Arbitrators or Umpire of the amount of the loss or damage if disputed shall first obtained.
22. In no case whatever shall the Company be liable for any loss or damage after the expiration of twelve (12) months from the happening of the loss or damage unless the claim is the subject of pending action of arbitration.
23. Every notice and other communication to the Company required by these Conditions must be written or printed.
24. In the event of a loss or damage unless all the necessary documents in support of the claim are received by the Company within (3) years from the date of the loss or damage all benefit under this Policy shall be forfeited.



ဆေးလိပ်ကင်းစင်နယ်မြေအဖြစ် သတ်မှတ်ထားခြင်း







**Info Myanmar University (IMU)**

လူမှုရေးဆိုင်ရာ ဆောင်ရွက်ချက်များ



သို့.

ဥက္ကဋ္ဌ

မြန်မာနိုင်ငံ ရင်းနှီးမြှုပ်နှံမှုကော်မရှင်

ရန်ကုန်မြို့။

စာအမှတ် ။ ။ IMC/Admin/2019(180)

ရက်စွဲ ။ ။ ၂၀၁၉ ခုနှစ်၊ မေလ၊ ၉ရက်။

အကြောင်းအရာ။

**လူမှုရေးဆိုင်ရာ ဆောင်ရွက်မှုအစီအစဉ်**

လူမှုရေးဆိုင်ရာဆောင်ရွက်မှုအစီအစဉ်အနေဖြင့် အသားတင် အမြတ်ငွေ၏ ၂ ရာခိုင်နှုန်းအား ထည့်ဝင်ရန် စီစဉ်ထားသည့်အပြင် အောက်ဖော်ပြပါ အစီအစဉ်များကို စီစဉ် ဆောင်ရွက်လျက်ရှိပါသည်။

• ပညာရေးကဏ္ဍ

- လူစွမ်းအား အင်အားစု ကို နည်းပညာအသုံးပြုမှု ကြောင့်ကွာဟခြင်း (digital divide) လျော့နည်းစေရေး၊ ဆင်းရဲနွမ်းပါးမှုလျော့ချရေး (poverty alleviation) တို့တွင် တစ်စိတ်တစ်ဒေသ အထောက်အကူ ပြုရန်ရည်ရွယ်၍ CSCU (Certified Secure Computer User) သင်တန်းကို ပညာဒါနအနေဖြင့် သင်ကြားပေးခြင်း
- EC – Council (USA) နှင့် ပူးပေါင်း၍ မြန်မာနိုင်ငံရှိ ကွန်ပျူတာအသုံးပြုနေသော user များအား ကွန်ပျူတာလုံခြုံရေး နှင့်ပါတ်သက်၍ အခါအားလျော်စွာ အခမဲ့သင်တန်း ပို့ချခြင်း
- ဝန်ထမ်းများစွမ်းဆောင်ရည် မြှင့်တင်ရေး (Capacity Building) အတွက်မူဝါဒ (Policy) လမ်းစဉ်များ ချမှတ် ဆောင်ရွက်လျက်ရှိခြင်း
  - သင်ကြားရေးဆရာ၊ ဆရာမများအတွက် အင်္ဂလန်နိုင်ငံရှိ မိတ်ဖက်တက္ကသိုလ်မှ ပညာရှင်များအား ဖိတ်ခေါ်၍ သက်ဆိုင်ရာဘာသာရပ် အလိုက်မွမ်းမံ သင်တန်းများ စီစဉ်ပေးခြင်း
  - IT Industry မှ ကျွမ်းကျင်ပညာရှင်များအား ဖိတ်ခေါ်၍ ဆရာ၊ဆရာမများနှင့် ဝန်ထမ်းများအား လေ့ကျင့်သင်ကြားပေးခြင်း
    - CISCO Training
    - Security Training
    - English Language Training
- မိမိ၏ ဝန်ထမ်း၊ ဆရာ/ဆရာမများအား နိုင်ငံတကာအသိအမှတ်ပြု စာမေးပွဲများဖြေဆိုရန် ပံ့ပိုးပေးခြင်း(International Certificate Exam)
- ဝန်ထမ်းများ၏ သားသမီးများအတွက် ပညာသင်စရိတ် ထောက်ပံ့ပေးခြင်း

• ကျန်းမာရေး စောင့်ရှောက်မှု ကဏ္ဍ

- နာမကျန်းသောဝန်ထမ်းများအတွက်ဆေးဝါး ကုသမှုကုန်ကျ စရိတ်များ ထောက်ပံ့ ကျခံပေးခြင်း
- ကမ္ဘာအေး ဗုဒ္ဓတက္ကသိုလ်၊မဟာဝိဟာရ မွေ့ဝိနယတက္ကသိုလ်မှ စာသင်သား သံဃာတော်များ ၏ ကျန်းမာရေး စောင့်ရှောက်မှု အတွက် - လစဉ်ဆေးဝါး နှင့် ဆရာဝန်လစာ လှူဒါန်းခြင်း





- သာသနာတော် ထွန်းကားပြန့်ပွားရေး ထောက်ပံ့လှူဒါန်းမှု ကဏ္ဍ
  - သံဃာတော်များအတွက် ကျောင်းတိုက်တည်ဆောက်ရန် မြေနေရာ လှူဒါန်းခြင်း
  - ရေတွင်းရေကန်များတူးဖော်ပေးခြင်း
  - ဝေးလံခေါင်ဖျားသော ဒေသများတွင် စေတီ ပုထိုးများတည်ထားလှူဒါန်းခြင်း
  - ဗုဒ္ဓတက္ကသိုလ်များသို့ လိုအပ်သည်များ (မော်တော်ယာဉ်၊ စားပွဲ၊ ကုလားထိုင်၊ ကော်ဇော၊ Computer(Laptop)၊ Server) ထောက်ပံ့လှူဒါန်းခြင်း (ဥပမာ - ကမ္ဘာအေး ဗုဒ္ဓတက္ကသိုလ်၊ မဟာဝိဟာရ ဓမ္မဂိနယတက္ကသိုလ်)
- လူမှုရေးကဏ္ဍ နှင့် ဒေသခံပြည်သူများဖွံ့ဖြိုးရေး ကဏ္ဍ
  - အသေးစား၊ အငယ်စားနှင့် အလတ်စား စီးပွားရေး လုပ်ငန်းများ ဖွံ့ဖြိုးတိုးတက်ရေး အေးဂျင်စီ (MSME Agency) ၏ လုပ်ငန်းဆောင်ရွက်မှုတိုးတက်စေရန်အတွက် Laptop များလှူဒါန်းခြင်း
  - NLD ဗဟို Research Department ၏ ICT အသုံးပြုနိုင်ရေးအတွက် Laptop များလှူဒါန်းခြင်း
  - ၂၀၁၆ တွင် ရေဘေးသင့်ပြည်သူများအား ဆန်အိတ် ၁၀၀ လှူဒါန်းခြင်း
  - ချင်းတောင်တန်း ဒေသမှ တိုင်းရင်းသားစာသင်သား ကလေးငယ်များ အဆင်ပြေ ချောမွေ့ စေရန်အတွက်ကျောင်းသုံး ကျောပိုးအိတ်များလှူဒါန်းခြင်း
  - ရခိုင်ပြည်နယ် မြောက်ဦး မှ ဘုန်းတော်ကြီးသင် ပညာရေးကျောင်း ဖွင့်လှစ်ထားသော ရက္ခပူရ ပညာရေး ဖောင်ဒေးရှင်း သို့ ကျောင်းသုံး ကျောပိုးအိတ် နှင့် အဝတ်အစားများ လှူဒါန်းခြင်း

မှတ်ချက်။ ။ ဆောင်ရွက်ခဲ့ပြီးသောမှတ်တမ်းများကို ပူးတွဲတင်ပြအပ်ပါသည်။

လေးစားစွာဖြင့်

နနသန့်

Founder & Managing Director

IMCS Co., Ltd.



**EC-Council | University**

**OverView:**

CSCU လက်မှတ်ကိုတော့ နည်းပညာနယ်ပယ်မှာ အထင်ကရ အဖွဲ့အစည်းတစ်ခုဖြစ်သော EC-Council မှပေးအပ်ချီးမြှင့်ခြင်း ဖြစ်ပါသည်။ EC-Council မှာ International Council of Electronic Commerce Consultants ဖြစ်ပြီး၊ ရုံးချုပ်သည် New Mexico ရဲ့ Albuquerque တွင်တည်ထောင်ထားပါသည်။ EC-Council သည် နိုင်ငံတကာအသိအမှတ်ပြု Certificate များကိုပေးအပ်လျှက် ရှိသော အဖွဲ့အစည်းတစ်ခုဖြစ်သည့် အပြင် EC-Council University ကိုဖွင့်လှစ်ထားပြီး၊ Master Degree Level အထိ Security Science ဘာသာရပ်များကိုပို့ချပေးလျက်ရှိပါသည်။

**Training Methodology & Materials:**

- One PC for one student
- Student will make many projects
- Fully Aircon & Nice Environment
- 24hr Free Internet Wi-fi
- Provide Coffee(Unlimited)

**Pre-requisites** - Basic understanding and working knowledge on Windows Admin.

**Course Fees : 150000-Ks**

## Your Learning Resources



### Course Outline

- Foundation of Security
- Securing Operating System
- Protecting Systems Using Antivirus
- Data Encryption
- Data Backup and Disaster Recovery
- Internet Security
- Security Network Connection
- Securing Online Transaction
- Securing Email Communication
- Social Engineering and Identity Theft
- Security on Social Networking Sites
- Information Security and Legal Compliance
- Securing Mobile Devices

### အကျိုးကျေးဇူးများ

လုံခြုံရေးနှင့် ပတ်သက်၍ ကိုယ်ရေးအချက်အလက်များ ခိုးယူခြင်း အကြောင်း၊ Credit Card ဆိုင်ရာလုံခြုံရေး၊ Online Banking ဆိုင်ရာ အချက်အလက်များ လုံခြုံရေး၊ Virus များနှင့် Backdoors များအကြောင်း၊ Hacking Attack နှင့် Social Engineering အကြောင်းများကို လေ့လာသင်ယူရမှာဖြစ်ပါတယ်။ လက်ရှိအသုံးပြု ထိတွေ့နေတဲ့ Social Networking, E-mail, General Office Work, Gaming, Streaming တို့ဟာလည်း လုံခြုံရေးအမြင်နဲ့ အသုံးပြုဖို့လိုအပ်တဲ့အတွက် ဒီဘာသာရပ် အတွင်းမှာ ထည့်သွင်း ထည့်သွင်း သင်ကြားရမှာဖြစ်ပါတယ်။ Cybersecurity Awareness Framework မှာပါဝင်တဲ့ အချက် (၂၄) ချက်ကို ပြည့်ပြည့်စုံစုံ သင်ကြား ရပြီး၊ Microsoft ရဲ့ Windows OS သာမက Apple ရဲ့ Mac OS လုံခြုံရေးပိုင်းကိုထည့်သွင်းသင်ကြားရမည် ဖြစ်၍ ဘဏ်များတွင်လည်းကောင်း၊ ဟိုတယ်ကြီးများတွင် လည်းကောင်း၊ Tele Communication ကုမ္ပဏီကြီးများတွင် လည်းကောင်း၊ IT ကုမ္ပဏီများတွင် လည်းကောင်း အလုပ်အကိုင် အခွင့်အလမ်းကောင်းများ ရရှိနိုင်ပါသည်။



IMCS မှ CSCU ( Certified Secure Computer User) Course ပညာဒီန သင်ကြားပေးခဲ့သော ကျောင်းသား/ကျောင်းသူစာရင်း

စဉ်	သင်တန်းဖွင့်လှစ်သော ခုနှစ်/ လ	ကျောင်းသား/သူအရေအတွက်
၁	၂၀၁၃ ဒီဇင်ဘာလ	၃၈
၂၀၁၃ စုစုပေါင်း		၃၈
၂	၂၀၁၄ မတ်လ	၁၃
၃	၂၀၁၄ မေလ	၃၈
၄	၂၀၁၄ ဇွန်လ	၁၆
၅	၂၀၁၄ ဇူလိုင်လ	၆၄
၆	၂၀၁၄ ဩဂုတ်လ	၂၆
၇	၂၀၁၄ နိုဝင်ဘာလ	၂၁
၈	၂၀၁၄ ဒီဇင်ဘာလ	၉၁
၂၀၁၄ စုစုပေါင်း		၂၆၉
၉	၂၀၁၅ ဇန်နဝါရီလ	၁၆
၁၀	၂၀၁၅ ဖေဖော်ဝါရီလ	၃၇
၁၁	၂၀၁၅ မတ်လ	၂၇
၁၂	၂၀၁၅ ဇွန်လ	၄၀
၁၃	၂၀၁၅ ဩဂုတ်လ	၁၄
၁၄	၂၀၁၅ စက်တင်ဘာလ	၄၀
၁၅	၂၀၁၅ ဒီဇင်ဘာလ	၄၁
၂၀၁၅ စုစုပေါင်း		၂၁၅
၁၆	၂၀၁၆ ဇန်နဝါရီလ	၂၂
၁၇	၂၀၁၆ မတ်လ	၃၉
၁၈	၂၀၁၆ မေလ	၆၅
၁၉	၂၀၁၆ ဇူလိုင်လ	၃၀
၂၀	၂၀၁၆ စက်တင်ဘာလ	၂၅
၂၁	၂၀၁၆ အောက်တိုဘာလ	၁၇
၂၂	၂၀၁၆ နိုဝင်ဘာလ	၃၃
၂၀၁၆ စုစုပေါင်း		၂၃၁
၂၃	၂၀၁၇ ဇန်နဝါရီလ	၆၁
၂၄	၂၀၁၇ ဧပြီလ	၃၈
၂၅	၂၀၁၇ ဇွန်လ	၃၅
၂၆	၂၀၁၇ ဇူလိုင်လ	၁၉
၂၇	၂၀၁၇ ဩဂုတ်လ	၂၈
၂၈	၂၀၁၇ အောက်တိုဘာလ	၂၀
၂၉	၂၀၁၇ နိုဝင်ဘာလ	၃၁
၂၀၁၇ စုစုပေါင်း		၂၃၂
၃၀	၂၀၁၈ ဇန်နဝါရီလ	၅၁
၃၁	၂၀၁၈ ဖေဖော်ဝါရီလ	၃၄
၃၂	၂၀၁၈ မေလ	၃၉
၃၃	၂၀၁၈ ဇွန်လ	၁၃
၃၄	၂၀၁၈ ဩဂုတ်လ	၂၃
၃၅	၂၀၁၈ အောက်တိုဘာလ	၁၄
၃၆	၂၀၁၈ နိုဝင်ဘာလ	၉
၂၀၁၈ စုစုပေါင်း		၁၈၃

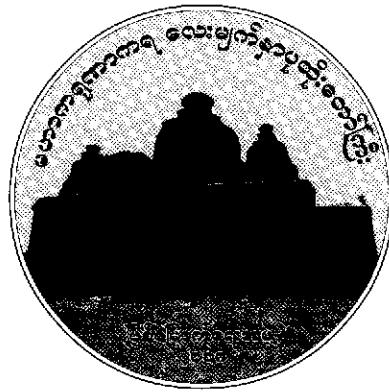
၃၇	၂၀၁၉ ဇန်နဝါရီလ	၂၁
၃၈	၂၀၁၉ မတ်လ	၁၂
၃၉	၂၀၁၉ မေလ	၁၂
၂၀၁၉ စုစုပေါင်း		၄၅
CSCU Course သင်ကြားပေးခဲ့သူ စုစုပေါင်း		၁၂၁၃

စုစုပေါင်း ပညာ ဒါန သင်ကြားပေးခဲ့သော ပမာဏ ကျပ်သိန်းပေါင်း ကိုးရာ့နှစ်ဆယ်သိန်းကျော်ရှိပြီး ယခုလက်ရှိတွင်လည်း ဖွင့်လှစ်လျက်ရှိသော သင်တန်းများတွင် လက်ခံ ထည့်သွင်း သင်ကြား ပေးလျက်ရှိပါသည်။

ရခိုင်ပြည်နယ်

ပေါက်တောမြို့နယ်

တောင်ချောင်ကျေးရွာ



မဟာကရုဏာကရလေးမျက်နှာပူထိုးတော်ကြီး

ဂုဏ်ပြုမှတ်တမ်းလွှာ

မြောက်ဦးမြို့၊ လေးမျက်နှာပူထိုးတော်ကြီးနှင့်ပုံစံတူ မဟာကရုဏာကရလေးမျက်နှာ ပူထိုးတော်ကြီးကို ရခိုင်ပြည်နယ်၊ ပေါက်တောမြို့နယ်၊ တောင်ချောင်ကျေးရွာ ဆင်ကျော် ကုန်းတောင်၌ တည်ထားကိုယ်ကွယ်နိုင်ရေးအတွက် အလှူငွေများ လှူဒါန်းပေးပါသော အောက်ဖော်ပြပါအလှူရှင်အား ဂုဏ်ပြုမှတ်တမ်းတင် သာဓုခေါ်ဆိုအပ်ပါသည်။

အလှူရှင်အမည် ဦး ကောင်း ဇော် ပိုင် + ဒေါ်ခွီ ခွီ သိန်း

နေရပ်လိပ်စာ Info Myanmar College, Pyaw Road, Yangon.

အလှူခေါင်းစဉ် လေးမျက်နှာပူထိုးတော်ကြီးတည်ဆောက်ရေး အလှူငွေ

လှူဒါန်းငွေ ဗျူဟာသိန်းလား (၄၀၀,၀၀၀) ကိလိ၊ (၃၀၀,၀၀၀ + ၂၀၂,၀၀၀)

နေ့စွဲ ၂၀၁၉ ခုနှစ်၊ မတ်လ၊ ၁၃ ရက်

0299

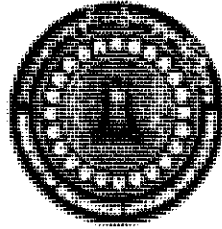
ဥက္ကဋ္ဌ

ပူထိုးတော်ကြီးမြန်မာ့မြောက်ရေးအဖွဲ့

ဗုဒ္ဓတက္ကသိုလ်များသို့ မော်တော်ယာဉ်လှူဒါန်းခြင်း



သာသနာရေးနှင့် ယဉ်ကျေးမှုဝန်ကြီးဌာန  
ရှေးဟောင်းသုတေသနနှင့် အမျိုးသားပြတိုက်ဦးစီးဌာန  
ပုဂံဌာနခွဲ၊ ပုဂံရှေးဟောင်းသုတေသနပြတိုက်ဌာနစု



## ဂုဏ်ပြုမှတ်တမ်းလွှာ

ရန်ကုန်တိုင်းဒေသကြီး၊ ကမာရွတ်မြို့နယ်၊ ဝင်ဒါမီယာနေ ဦးကောင်းမြတ်ပိုင် + ဒေါ်နုနုသန့်မိသားစု  
(Info Myanmar College) မှ ပုဂံရှေးဟောင်းသုတေသနပြတိုက်  
သုတေးဆင်းတုတော်များပြခန်းရှိ ဆင်းတုတော်များ၏အောက်ခံ (စမ္မံ)များအတွက် ငွေ(၉၄၆၀၀၀)ကျပ်  
တန်ဖိုးရှိသော စမ္မံအခင်း (၁၀၀)ခုအား လှူဒါန်းခဲ့ပါသဖြင့် ပုဂံရှေးဟောင်းသုတေသနပြတိုက်မှ  
အထူးပင်ကျေးဇူးတင်ရှိကြောင်း ဂုဏ်ပြုမှတ်တမ်းတင်အပ်ပါသည်။

( ညီမွန်း )

ဒုတိယညွှန်ကြားရေးမှူး

ပုဂံရှေးဟောင်းသုတေသနပြတိုက်



အသေးစား၊ အငယ်စားနှင့် အလတ်စား  
စီးပွားရေးလုပ်ငန်းများ ဖွံ့ဖြိုးတိုးတက်ရေးအေဂျင်စီ



ဂုဏ်ပြုမှတ်တမ်းလွှာ

MSME Agency အတွက်

Laptop Computer (၁၀) လုံးအားလှူဒါန်းပေးပါသော

**“Info Myanmar College”**

အား ကျေးဇူးအထူးတင်ရှိကြောင်း

ဂုဏ်ပြုမှတ်တမ်းတင်အပ်ပါသည်။

အောင်ထူး

ဥက္ကဋ္ဌ

MSME အေဂျင်စီ

၂၀၁၉ ခုနှစ်၊ မေလ ၇ ရက်



အသေးစား၊ အငယ်စားနှင့် အလတ်စား  
စီးပွားရေးလုပ်ငန်းများ ဖွံ့ဖြိုးတိုးတက်ရေးအေဂျင်စီ



ဂုဏ်ပြုမှတ်တမ်းလွှာ

ချင်းပြည်နယ် MSME Agency အတွက်  
ရုံးလုပ်ငန်းများတွင် အသုံးပြုရန်  
Laptop Computer (၅) လုံးအားလှူဒါန်းပေးပါသော

**“Info Myanmar College”**

အား ကျေးဇူးအထူးတင်ရှိကြောင်း  
ဂုဏ်ပြုမှတ်တမ်းတင်အပ်ပါသည်။

အောင်ထူး  
ဥက္ကဋ္ဌ  
MSME အေဂျင်စီ

ဆလိုင်းလျန်လွယ်  
နာယက  
ချင်းပြည်နယ် MSME အေဂျင်စီ

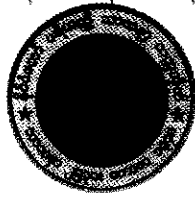
၂၀၁၉ ခုနှစ်၊ မေလ ၇ ရက်



အသေးစားနှင့်အလတ်စားလုပ်ငန်းများ နှင့် NLD ဗဟို Research Department ၏ လုပ်ငန်းဆောင်ရွက်မှုတိုးတက်စေရန် ICT အသုံးပြုနိုင်ရေးအတွက် Laptop အရုံး၂၀ လှူဒါန်းခြင်း







နိုင်ငံတော်သံယမဟာနာယကအဖွဲ့  
**နိုင်ငံတော်ပရိယတ္တိသာသနာ့တက္ကသိုလ်(ရန်ကုန်)**  
**ပရမလာဘ ကုသိုလ်ပြုစဉ်**  
**မှတ်တမ်းတင် ဂုဏ်ပြုချက်**

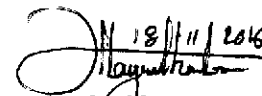
ရက်စွဲ ...၁၈.၁၁.၂၀၁၆.

- (က) အကျင့်သိက္ခာမြင့်မားစေရန်၊
- (ခ) ပိဋကတ်ကျမ်းဂန်နှစ်စပ်စေရန်၊
- (ဂ) ပါဠိဘာသာတတ်မြောက်ကျွမ်းကျင်စေရန်၊
- (ဃ) မြန်မာစာအရေးအသားတော်စေရန်ဟူသော

ပညာရေးမူဝါဒလေးချက်ကို အခြေခံ၍ ပြည်တွင်းပြည်ပတို့၌ သာသနာပြုစွမ်းနိုင်သော အာဇာနည်အရှင်မြတ်များ ပေါ်ထွက်လာစေရန် ရည်ရွယ်ချက်ဖြင့် တည်ထောင်ဖွင့်လှစ်ထားသည့် နိုင်ငံတော်ပရိယတ္တိသာသနာ့တက္ကသိုလ်(ရန်ကုန်)၌ သီတင်းသုံးတော်မူကြသော သင်ကြားစီမံဆရာတော်များနှင့် သင်တန်းသားသံဃာတော်အရှင်မြတ်များ သက်ရည်ကျန်းမာ သာသနာပြုနိုင်ရန်အတွက် အာယုဒါန၊ ဇီဝိတဒါန၊ ဘောသဇ္ဇဒါန၊ အာရောဂျဒါန အမည်ရသော အလှူတော်ကို သဒ္ဓါထက်သန် သာသနာ့အားမာန်ဖြင့် နိဗ္ဗာန်ရည်မှန်း လှူဒါန်းပါသော ဖော်ပြပါ ကုသိုလ်ရှင်အား ပရမလာဘဂုဏ်တင် မြတ်သောကုသိုလ်ရှင်အဖြစ် ထာဝရမှတ်တမ်းတင်ဂုဏ်ပြုပါသည်။

အမှတ်စဉ် .....  
 အမည် INFO.MYANMAR...COLLEGE.....မှိဘားရှု.....  
 နေရပ် ..ရန်ကုန်.....  
 လှူဒါန်းမှု ..ဒေါ.ဝေ.ဝေ.ဝေ.အေး(အိန္ဒြာ).....

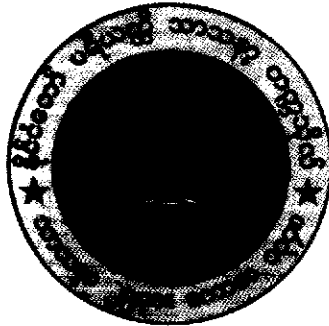
အာရောဂျပရမာ လာဘာ  
 လာဘ်အားလုံးတို့တွင်  
 အနာကင်းခြင်းဟူသော လာဘ်သည်  
 အမြတ်ဆုံးဖြစ်၏။

  
 မော်ကွန်းထိန်းဆရာတော် (My)  
 နိုင်ငံတော်ပရိယတ္တိသာသနာ့တက္ကသိုလ်(ရန်ကုန်)  
 ကမ္ဘာအေးကုန်းမြေ၊ ရန်ကုန်မြို့

နိုင်ငံတော်ထံသဘောတူညီကြောင်း

နိုင်ငံတော်ပရိယတ္တိသာသနာ့တက္ကသိုလ်(ရန်ကုန်)

မဟာတိပိဋကဓရ ဓမ္မဘာလ္လာဂါရိက ပိဋကတ်စာကြည့်တိုက်



# ပညာပါရမီကုသိုလ်တော်

မှတ်တမ်းတင်ရက်ပြုလွှာ



နိုင်ငံတော်ပရိယတ္တိသာသနာ့တက္ကသိုလ် (ရန်ကုန်) မဟာတိပိဋကဓရ ဓမ္မဘာလ္လာဂါရိက ပိဋကတ်စာကြည့်တိုက်အတွက် အလှူငွေ၊ စာအုပ်/စာတမ်း နှင့် ဆက်စပ်ပရိယတ္တိများကို စေတနာ၊ သဒ္ဓါ ထက်သန်စွာဖြင့် ပါဝင်လှူဒါန်းသော အောက်ဖော်ပြပါ အလှူရှင်၏ သာသနာပြု ပညာပါရမီကုသိုလ်တော်ကို ဝမ်းမြောက်ဝမ်းသာ သာဓုအနုမောဒနာ ခေါ်ဆိုနိုင်ရန် မှတ်တမ်းတင်ရက်ပြုပါသည်။

အမှတ်စဉ် - ( )

● အလှူရှင်အမည်

Info Myanmar Collection - အသားရ

● နေရပ်လိပ်စာ

၁၀၅/၇ - ပြည်လမ်းသာလမ်း၊ ပြည်လမ်း၊ ကမာရွတ်

● အလှူငွေ/ပစ္စည်း

အထွေထွေနှင့် အသားရ

● လှူဒါန်းသည့်ရက်စွဲ

၁၁.၁၁.၂၀၁၇

တက္ကသိုလ်မှူးဆရာတော်

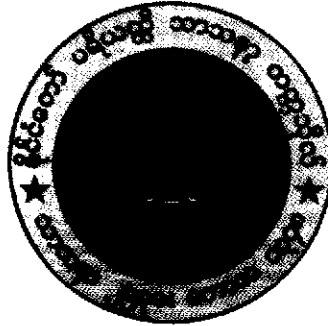
နိုင်ငံတော်ပရိယတ္တိသာသနာ့တက္ကသိုလ်

ကမ္ဘာအေးကုန်းမြို့၊ ရန်ကုန်မြို့

နိုင်ငံတော်သံသဟောနာသထအဖွဲ့

နိုင်ငံတော်ပရိယတ္တိသာသနာ့တက္ကသိုလ် (ရန်ကုန်)

မဟာတိပိဋကဓရ ဓမ္မဘဏ္ဍာဂါရိက ပိဋကတ်စာကြည့်တိုက်



# ပညာပါရမီကုသိုလ်တော်

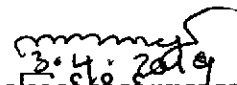
မှတ်တမ်းတင်ဂုဏ်ပြုလွှာ



နိုင်ငံတော်ပရိယတ္တိသာသနာ့တက္ကသိုလ် (ရန်ကုန်) မဟာတိပိဋကဓရ ဓမ္မဘဏ္ဍာဂါရိက ပိဋကတ်စာကြည့်တိုက်အတွက် အလှူငွေ၊ စာအုပ်/စာတမ်း နှင့် ဆက်စပ်ပရိဘောဂများကို စေတနာ၊ သဒ္ဓါ ထက်သန်စွာဖြင့် ပါဝင်လှူဒါန်းသော အောက်ဖော်ပြပါ အလှူရှင်၏ သာသနာပြု ပညာပါရမီကုသိုလ်တော်ကို ဝမ်းမြောက်ဝမ်းသာ သာဓုအနုမောဒနာ ခေါ်ဆိုနိုင်ရန် မှတ်တမ်းတင်ဂုဏ်ပြုပါသည်။

အမှတ်စဉ် - (                      )

- အလှူရှင်အမည်     Info Myanmar College - မိဇာ-စု-  
-----
- နေရပ်လိပ်စာ     505-17 - ပြည်လုံသာယာ - ပြည်လမ်း - ရန်ကုန်  
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- အလှူငွေ/ပစ္စည်း     25 - သိန်း  
-----
- လှူဒါန်းသည့်ရက်စွဲ     16 - 11 - 2018  
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စာကြည့်တိုက်မှူးဆရာတော်

နိုင်ငံတော်ပရိယတ္တိသာသနာ့တက္ကသိုလ်

ကမာအေးကန်မမြ၊ ရန်ကုန်မြို့

တစ်ကိုယ်တော် ပရဟိတသမားများ ကွန်ရက်



**ဂုဏ်ဖြူစင်တမ်းလွှာ**

ရက်စွဲ.....၁၆.၂.၂၀၁၇

အလှူရှင် ..... Info Myanmar College.....

နေရပ် ..... ခရီးကုန် .....

အကြောင်းအရာ အဖွဲ့ဝင်ကလေးများ၏ စာတမ်းကို ရှိရင်းစား ကမ္ဘာ့ကျန်းမာရေးနှင့်  
ကုသမှု

အသုံးပြုသူ/ပစ္စည်း: ..... Lenovo ကုမ္ပဏီမှ (သတင်း).....

ကို ကျေးဇူးတင်စွာ လက်ခံရရှိပါသည်။

ကွန်ရက်ကိုယ်စား -

စင်စစ်ကြည့်ရအောင်

245

ဆက်သွယ်လျှင် နားလို့ပါက -

စာစီတိုက်ခတ်ပေရဟိတ ဝမ်းချမ်းစွာရှိရန်

ရန်ကုန် - ဝဠာဇာကျေဇာဠာ ၊ ဝဠာဠာဇာဠာဠာ

စင်ကာပူ - ၁၇၁၀၃၄၃

email – [tacotawaltruists.network@gmail.com](mailto:tacotawaltruists.network@gmail.com)

[www.facebook.com/tacotaw.parahitathamarmyar](http://www.facebook.com/tacotaw.parahitathamarmyar) တွင်လေ့လာနိုင်ပါသည်။



တိုင်းရင်းသား ကလေးငယ်များ အတွက်ကျောင်းသုံး ကျောပိုးအိတ်များ လှူဒါန်းခြင်း





၂၀၁၆ ရေဘေးသင့်ပြည်သူများအား ဆန်များလှူဒါန်းခြင်း



## CISCO Training စီစဉ်သင်ကြားပေးခြင်း





# မဟာဝိဟာရကျောင်းတိုက်

ရန်ကုန်တိုင်းဒေသကြီး၊ မော်ဘီမြို့နယ်၊ ဘိုးဒေါနကုန်းကျေးရွာ

(ထေရဝါဒဗုဒ္ဓသာသနာ့စေတီတို့တိုယ်တူငွေစာရင်းဖြင့်ထင်ရှားစေမည်)

## ဂုဏ်ပြုမှတ်တမ်းလွှာ

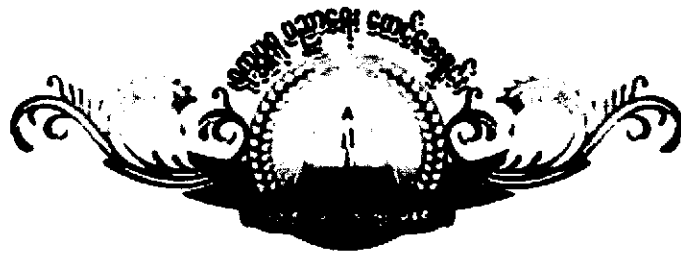
“မဟာဝိဟာရကျောင်းတိုက်ရှိ သံဃာတော်များ”

ပရိယတ် ပဋိပတ်များကို ရှမ်းသာစွာ ဆည်းပူး သင်ယူ အားထုတ်နိုင်ရန် အတွက်  
အလှူငွေ လှူဒါန်းပေးအပ်ပါသော အလှူရှင်များအား မှတ်တမ်းတင် ဂုဏ်ပြုအပ်ပါသည်။

အလှူရှင်အမည်	ကို.ကော့င်း၊မြတ်၊ဦး + မ.ခွေခွေသန်း၊ မ.ဂ်.လာဦး၊အ.လေး.....
နေရပ်လိပ်စာ	လွ.ခင်း.တန်း.၊ ရန်ကုန်မြို့.....
အကြောင်းအရာ	အေး.ပ.ဒေသာပင်.....
အလှူငွေ (ဂဏန်းဖြင့်)	၅၀၀၀၀၀၀/-.....
(စာဖြင့်)	ကျပ်ငါးဆယ်ထောင်.....



# ရက္ခပူရ ပညာရေးဟောင်းဒေးရှင်း



ပညာရေးသည် ဆင်းရဲခြင်း၏ ထွက်ပေါက်  
ပညာရှယ် ဖြစ်နိုင်မည်၊ ပညာဖြင့်မှ လူဖွယ်တင့်မည်။

## သာသနာ့အရေးအခင်းများ ချီးကျူးမှုကို တားမြစ်သော သာသနာ့အရေးအခင်းများကို ပြောဆိုခြင်း

အလှူရှင်အမည်

နေရပ်လိပ်စာ

အလှူငွေ

အလှူရှင်ကိုယ်ရေးအကျဉ်း

ဦးကောင်းမြတ်စိန် + ဒေါ်နုနုသက်  
INFO-MYANMAR College  
ကျေးဇူးတင် (134) က  
၈၆၈၈၈၈ (17) က  
၈၆၈၈၈၈ (11) က  
၈၆၈၈၈၈ (24) က

အထက်ပါ ကုသိုလ်ရှင်ထံမှ အောက်စည်းမောင်းကျေးရွာရှိ ရက္ခပူရပညာရေးဟောင်းဒေးရှင်း ၏ ပညာရေး ရေရှည်တည်တံ့နိုင်မြဲရေးအတွက် စာတိဂုဏ် သဖွယ်တရား ထက်သန်စွာဖြင့် ထာဝရငွေပဒေသာပင်လှူဒါန်းထားပါသဖြင့် ရက္ခပူရပညာရေးဟောင်းဒေးရှင်းမှ သာသနာ့အရေးအခင်းများ ချီးကျူးမှုကို တားမြစ်သော သာသနာ့အရေးအခင်းများကို ပြောဆိုခြင်း

ဤကောင်းမှုကုသိုလ်ကို အစဉ်အမြဲ သတိရ ပွားများပြီး စာဂါနုသတိ ထာဝရဖြစ်စေ၍ အရေးအခင်းများ ချီးကျူးမှုလွှာဖြင့် လေးစားစွာ ဂုဏ်ပြုအပ်ပါသည်။

အရှင်သုတ  
ဥက္ကဋ္ဌဆရာတော်

အရှင်ဆရာမိက  
နာယက

ရက္ခပူရပညာရေး ဟောင်းဒေးရှင်း

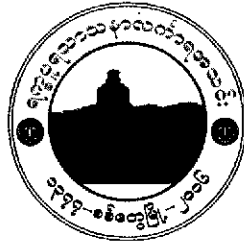
အောက်စည်းမောင်းကျေးရွာ၊ မြောက်ဦးမြို့နယ်၊ ရခိုင်ပြည်

ရန်-ဝေ့ကုသေဋ္ဌဝေဋ္ဌ

ဝေ့ကုသေဋ္ဌဝေဋ္ဌ

(၁၆ ရက်၊ ၉၂ ခု၊ ဧပြီလ ၁၈ ရက်)

“သီလဝတော ပညာ ၊ ပညာဝတော သီလ”  
သီလရှိသူမှာ ပညာရှိ၏။ ပညာရှိသူမှာ သီလရှိ၏။



## ရက္ခပူရသာသနာလင်္ကာရအသင်း

### အလှူရှင် မှတ်တမ်းတင်ဂုဏ်ပြုလွှာ



ရက္ခပူရသာသနာလင်္ကာရစာမေးပွဲ ကျင်းပနိုင်ရေးအတွက် အလှူငွေ လှူဒါန်းပေးပါသော အလှူရှင်အား ဤဂုဏ်ပြုမှတ်တမ်းလွှာဖြင့် မှတ်တမ်းတင် ဂုဏ်ပြုအပ်ပါသည်။

အလှူရှင်အမည်	ဆိုဧကောင်း၊ ဖြတ်ချိတ် - တစ်ကြိမ်လုံး - - - - -
ဂုဏ်ထူး	- The Myanmar Relief, Inc. Ltd - -
နေရပ်လိပ်စာ	- ၅၀၇၂၇, ဗဟန်းရိပ်သာလမ်း၊ + ရန်ကုန်မြို့ - - -

အလှူငွေ (ဂဏန်းဖြင့်) - - ၅ ၀၅၀၀၀ / - - - - -  
(စာဖြင့်) - - ငါးသိန်း ဖြစ်တယ် - - - - -

ဥက္ကဋ္ဌ



# မဟာဝိဟာရကျောင်းတိုက်

ရန်ကုန်တိုင်းဒေသကြီး၊ မှော်ဘီမြို့နယ်၊ ဘိုးဒေါနကုန်းကျေးရွာ

(ထေရဝါဒဗုဒ္ဓသာသနာ့စေတီတို့တိုယ်ကျင့်စာရေးငြိမ်းစင်ရှားစေမည်)

## ဂုဏ်ပြုမှတ်တမ်းလွှာ

“မဟာဝိဟာရကျောင်းတိုက်ရှိ သံဃာတော်များ”

ပရိယတ် ပဋိပတ်များကို ရှမ်းသာစွာ ဆည်းပူး သင်ယူ အားထုတ်နိုင်ရန် အတွက်  
အလှူငွေ လှူဒါန်းပေးအပ်ပါသော အလှူရှင်များအား မှတ်တမ်းတင် ဂုဏ်ပြုအပ်ပါသည်။

အလှူရှင်အမည် . Ina... Myanmar... College... .. ဗု.....

နေရပ်လိပ်စာ . ရန်ကုန်မြို့.....

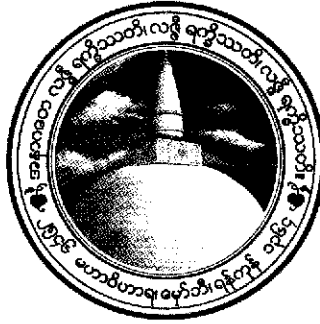
အကြောင်းအရာ . ဆရာတော်အားလုံး ( ၅ , ၆ , ၇ , ၈ ) ၂၀၁၆ ခုနှစ်

အလှူငွေ (ဂဏန်းဖြင့်) . ၁၄၀၀၀၀၀၀ - .....

(စာဖြင့်) . ကျပ်တစ်ဆယ်လေးသိန်းငါးထောင် .....

ရက်စွဲ - ၈ - ၁ - ၂၀၁၇

ဆွမ်းကွမ်းဝေယျာဝစ္စအဖွဲ့  
မဟာဝိဟာရကျောင်းတိုက်  
ဘိုးဒေါနကုန်းကျေးရွာ၊ မှော်ဘီမြို့နယ်



# မဟာဝိဟာရကျောင်းတိုက်

ရန်ကုန်တိုင်းဒေသကြီး၊ မော်ဘီမြို့နယ်၊ ဘိုးဒေါနကုန်းကျေးရွာ

(ထေရဝါဒဗုဒ္ဓသာသနာ့စေတီတို့တိုင်းထူထောင်ရေးနှင့် ထိန်းသိမ်းရေးဥပဒေ)

## ဂုဏ်ပြုမှတ်တမ်းလွှာ

“မဟာဝိဟာရကျောင်းတိုက်ရှိ သံဃာတော်များ”

ပရိယတ် ပဋိပတ်များကို ချမ်းသာစွာ ဆည်းပူး သင်ယူ အားထုတ်နိုင်ရန် အတွက်  
အလှူငွေ လှူဒါန်းပေးအပ်ပါသော အလှူရှင်များအား မှတ်တမ်းတင် ဂုဏ်ပြုအပ်ပါသည်။

အလှူရှင်အမည် . In fo . . . Myanmar . . . College . . . . .

နေရပ်လိပ်စာ . . . . . ရန်ကုန် . . . . .

အကြောင်းအရာ . . . . . ဆရာတော် လစာ ၂၁ လစာ အတွက် (March  
April)

အလှူငွေ (ဂဏန်းဖြင့်) . . . . . ၇၀၀၀၀၀/-

(စာဖြင့်) . . . . . ကျပ် ၇၀၀ အိမ် တိတိ

ဆွမ်းကွင်းဝေယျာဝစ္စအဖွဲ့

မဟာဝိဟာရကျောင်းတိုက်

ဘိုးဒေါနကုန်းကျေးရွာ၊ မော်ဘီမြို့နယ်

ရက်စွဲ- ၄.၁၀.၁၆





# မဟာဝိဟာရကျောင်းတိုက်

ရန်ကုန်တိုင်းဒေသကြီး၊ မော်ဘီမြို့နယ်၊ ဘိုးဒေါနကုန်းကျေးရွာ

(ထေရဝါဒဗုဒ္ဓသာသနာ့စောရိတရတိပဋိပက္ခဌာန၊ ဗြဟ္မစရိယဌာန၊ ဗြဟ္မစရိယဌာန)

## ဂုဏ်ပြုမှတ်တမ်းလွှာ

“မဟာဝိဟာရကျောင်းတိုက်ရှိ သံဃာတော်များ”

ပရိယတ် ပဋိပတ်များကို ချမ်းသာစွာ ဆည်းပူး သင်ယူ အားထုတ်နိုင်ရန် အတွက်  
အလှူငွေ လှူဒါန်းပေးအပ်ပါသော အလှူရှင်များအား မှတ်တမ်းတင် ဂုဏ်ပြုအပ်ပါသည်။

အလှူရှင်အမည် In fo.. Myanmar... College..... မီးသီးစု.....  
နေရပ်လိပ်စာ ရန်ကုန်မြို့.....  
အကြောင်းအရာ ၂၀၁၆- ၂၀၁၇ ခုနှစ် အတွက် ဆရာတော်လစာစာလှူ.....  
အလှူငွေ (ဂဏန်းဖြင့်) : ၄၅၀၀၀၀/-  
(စာဖြင့်) ကျပ်သုံးသိန်း ငါးဆောင်း နှစ်ထောင်

စွမ်းကွမ်းဝေယျာဝစ္စအဖွဲ့ ( နိုမီနီ )  
မဟာဝိဟာရကျောင်းတိုက်  
ဘိုးဒေါနကုန်းကျေးရွာ၊ မော်ဘီမြို့နယ်



**Info Myanmar University (IMU)**

အရက်သေစာနှင့် မူးယစ်ဆေးဝါးသုံးစွဲခြင်း  
မရှိစေရေး ဝန်ခံကတိပြုလွှာ





သို့.

ဥက္ကဋ္ဌ

မြန်မာနိုင်ငံ ရင်းနှီးမြှုပ်နှံမှုကော်မရှင်

ရန်ကုန်မြို့။

စာအမှတ် ။ ။ IMC/Admin/2019(181)

ရက်စွဲ ။ ။ ၂၀၁၉ ခုနှစ်၊ မေလ၊ ၉ရက်။

အကြောင်းအရာ။ ။ အရက်သေစာနှင့် မူးယစ်ဆေးဝါးသုံးစွဲခြင်း မရှိစေရေး ဝန်ခံကတိပြုတင်ပြခြင်း။

အထက်အကြောင်းအရာပါကိစ္စနှင့်စပ်လျဉ်း၍ ကျွန်ုပ်တို့၏ IMCS (Institute of Management & Computer Studies) Company Limited ၊ ကုမ္ပဏီ မှတ်ပုံတင်အမှတ် (103990572)သည် Info Myanmar University အမည်ဖြင့် ပုဂ္ဂလိကပညာရေးဝန်ဆောင်မှုများ ဆောင်ရွက်ရာတွင် အရက်သေစာနှင့် မူးယစ်ဆေးဝါးသုံးစွဲခြင်း မရှိစေရေး အတွက် အစီအစဉ်များ ဆောင်ရွက်ထားရှိမည် ဖြစ်ကြောင်းကတိပြု တင်ပြအပ်ပါသည်။ ယခုလက်ရှိတွင်လည်း

(၁) အရက်သေစာ၊ ဆေးလိပ်၊ မူးယစ်ဆေးဝါးများ သုံးစွဲမှု မရှိစေရေး စည်းကမ်း နှင့် မူဝါဒများချမှတ်ထားခြင်း

(၂) ဆေးလိပ်မှတစ်ဆင့် မူးယစ်ဆေးဝါးသုံးစွဲခြင်း မဖြစ်စေရန် ဆေးလိပ်ငွေ့ကင်းစင်နယ်မြေ အဖြစ်သတ်မှတ်၍ ဆေးလိပ်သောက်သုံးခြင်းကိုတင်းကြပ်စွာတားမြစ် စစ်ဆေးခြင်း၊ အရေးယူပြစ်ဒဏ်ပေးခြင်း

(၃) ဆေးလိပ် နှင့် မူးယစ်ဆေးဝါး အန္တရာယ်အသိပညာပေး ဟောပြောပွဲများ ပြုလုပ်ခြင်း

- တို့ကို စီစဉ် ဆောင်ရွက်လျက် ရှိပါသည်။

လေးစားစွာဖြင့်

နနသန့်

Founder & Managing Director

IMCS Co., Ltd.



မူးယစ်ဆေးဝါးခွဲသုများ ပြန်လည်ထူထောင်ရေးအသင်း (မြန်မာ) ဗဟို



ကျေးဇူးတင် ဂုဏ်ပြုလွှာ



Info Myanmar College မှ ကြီးပွားကျင်းပပြုလုပ်သော  
 "မူးယစ်ဆေးဝါးအန္တရာယ် အသိပညာပေးဟောပြောပွဲ" တွင် မူးယစ်ဆေးဝါးခွဲသုများပြန်လည်  
 ထူထောင်ရေးအသင်း (မြန်မာ) ဗဟိုသို့ ဖိတ်ကြားဟောပြောခွင့်ပြုသည့်အတွက် အသင်းမှ  
 "Info Myanmar College" ပညာရေးမိသားစုအား အထူးပင် ကျေးဇူးတင်  
 ဂုဏ်ပြုအပ်ပါသည်။

ဦးစံရှိန်  
 ၃၁၄

မူးယစ်ဆေးဝါးခွဲသုများပြန်လည်ထူထောင်ရေးအသင်း  
 (မြန်မာ) ဗဟို



မူးယစ်ဆေးဝါးအန္တရာယ်အသိပညာပေးဟောပြောပွဲဆောင်ရွက်မှုများ





**Info Myanmar University (IMU)**

အမျိုးသား ပညာရေးဥပဒေ၊  
တည်ဆဲပညာရေးဆိုင်ရာ ဥပဒေများနှင့်  
နောင်ထွက်ပေါ်လာမည့် ပညာရေး ဥပဒေများကို  
လိုက်နာဆောင်ရွက်သွားမည်ဖြစ်ကြောင်း  
ဝန်ခံကတိ



သို့.

ဥက္ကဋ္ဌ

မြန်မာနိုင်ငံ ရင်းနှီးမြှုပ်နှံမှုကော်မရှင်

ရန်ကုန်မြို့။

စာအမှတ် ။ ။ IMC/Admin/2019(182)

ရက်စွဲ ။ ။ ၂၀၁၉ ခုနှစ်၊ မေလ၊ ၉ရက်။

အကြောင်းအရာ။ ။ အမျိုးသား ပညာရေးဥပဒေ၊ တည်ဆဲပညာရေးဆိုင်ရာ ဥပဒေများနှင့် နောင်တွင်ပေါ်  
လာမည့် ပညာရေး ဥပဒေများကိုလိုက်နာဆောင်ရွက်သွားမည်ဖြစ်ကြောင်း ဝန်ခံကတိ ပြုခြင်း။  
အထက်အကြောင်းအရာပါကိစ္စနှင့်စပ်လျဉ်း၍ ကျွန်ုပ်တို့၏ IMCS (Institute of  
Management & Computer Studies) Company Limited ၊ ကုမ္ပဏီ မှတ်ပုံတင်အမှတ် (103990572)သည် Info  
Myanmar University အမည်ဖြင့် ပုဂ္ဂလိကပညာရေးဝန်ဆောင်မှုများ ဆောင်ရွက်ရာတွင် အမျိုးသား ပညာရေးဥပဒေ၊  
တည်ဆဲပညာရေးဆိုင်ရာ ဥပဒေများ၊ နောင်တွင်ပေါ်ထွက်ပြဌာန်းလာမည့် ပညာရေးဥပဒေများ နှင့် National  
Assessment များကို လိုက်နာဆောင်ရွက်သွားမည်ဖြစ်ကြောင်း ကတိပြု တင်ပြအပ်ပါသည်။

လေးစားစွာဖြင့်

နနသန့်

Founder & Managing Director

IMCS Co., Ltd.